MARINE REVIEW

VOL. XX. Published every Thursday at 418-19 Perry-Payne Bldg., by the Marine Review Pub. Co. CLEVELAND, O., SEPT. 28, 1899. Subscription $2.00 a year. Foreign $3.50 a year. No. 13

THE PROGRESS OF OUR NAVY.

The greatest hero in the naval history of America returns from the victory that won him fame to find the navy of his country at the end of the first epoch of a development which for rapidity and scope is without a parallel among the nations of the earth. In the comparatively brief space of time since Admiral Dewey departed from this country for the Orient, the tangible effective naval strength of the United States has increased almost one-third. Much of the increase, it is true, was necessitated by the exigencies of a suddenly precipitated war. The conflict, short in duration, would have been of inestimable benefit had the result been nothing more than the arousal of general public interest in the growth and welfare of the navy so strikingly portrayed by the addition since made to our striking strength upon the water.

To all intents and purposes the United States is now the third naval power of the world. Germany is a vigilant, active, aggressive rival, whose energy in this direction, constantly fostered by a ruling power, may be expected to increase rather than diminish. Japan, the coming commercial power of the other hemisphere, started in not long ago to annihilate with giant strides the modicum of our supremacy. But matters have changed of late and the United States will continue, for some time at least, to be excelled as a naval power only by Great Britain and France.

The full strength of the navy of the United States now amounts to 312 vessels of all kinds, built and building. Of this number 189 are in the regular navy and 123 constitute the auxiliary force, for the accumulation of which we are largely indebted to the necessities of the Spanish-American war. Something of the pace at which we are moving forward may be imagined when it is stated that roughly estimated the existing naval fleet represents an expenditure for construction of about $125,000,000, and yet there are now under construction or awaiting formal acceptance by the government more than half a hundred war vessels, the contract price for which, exclusive of armor and armament, is in the neighborhood of $40,000,000.

The war almost doubled the aggregate of men on our war vessels. At the outset the complement was 12,500 men, but in the summer of 1898 it reached the maximum figure of 24,123 men. Since that time it has, of course, decreased considerably, but the incoming congress is expected to authorize a permanent naval strength of upwards of 20,000 men. Nor, in passing, should mention be omitted of the success which has attended the amalgamation of the line and staff. An experiment, watched by students of naval administration everywhere, its beneficial effects have been discernable instantaneously.

For the future, bright hopes may be based upon the most favorable of indications. Congressmen have been spending the summer of 1899 in the study of naval science abroad. Places on the naval committee have been eagerly sought. Already a new atmosphere of liberality and intelligence characterizes the consideration of naval problems and affords ground for hope that never again will the march of progress be retarded by such a lack of knowledge as made possible the late fiasco relative to the limitation of armor prices.

New battleships, armored and protected cruisers are to be constructed. Each class is quite certain to mark a step forward in the science of building vessels of war. Rear Admiral George W. Melville declares to the Review that the new battleships should be of 20 knots speed; that they should carry large batteries of rapid fire guns; have ample coal bunker capacity and be fitted with triple screws—radical revolutionary measures, all, but vital in influence if successful.

Already the eyes of every naval officer across the Atlantic are upon us. Within the past month two of our new battleships have exceeded contract speed. The practicability of that most novel of ideas—the superimposed turrets of the Kearsarge—will soon be put to the test. We are preparing to outdo the British in the thoroughness of our experiments with liquid fuel and wireless telegraphy. Finally we are investigating the possibilities of the submarine boat and our conclusions will have enhanced value because they will be characterized by neither the enthusiastic optimism of the French or the cynicism of the conservative Britons.

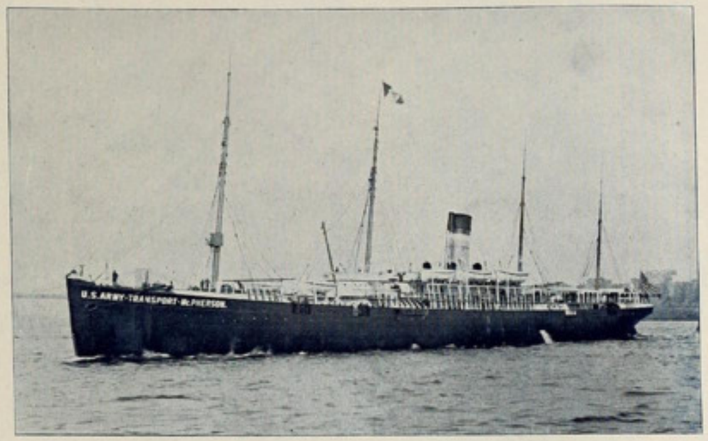
For well-rounded naval development every essential must be adequate. Thus there is no greater cause for congratulation than over the manner in which the ship yards of America have met the requirements imposed by new conditions. The past few years have seen no less than half a dozen firms actively engaged upon naval contracts, although their previous experience had been entirely confined to mercantile craft. Several of them, at the initial attempt, constructed vessels which exceeded contract speed.

Heretofore the Powers have charged us with being deficient in the matter of diversity of strength in our naval fleet. This is true no longer, for with the completion of the vessels now on the stocks we will have more than half a hundred torpedo boats and destroyers. Here, too, American builders have been daring, for who will contend that it is not venturesome to guarantee a speed in excess of 30 knots on a smaller displacement than has ever before been attempted by any ship builder the world over—and that, too, when the contract is the first of the torpedo-boat kind for the firm undertaking it.

Even down to the details the United States navy will be unique. No other nation has found so appropriate a form of designation for its fighting craft. Our states have given us names for two dozen; two score of our cities have namesakes in our navy, and finally no less than thirty of our naval heroes have had their names commemorated by war vessels. It is a novel navy and a magnificent one, and with its strength considered it is the most interesting on the waters of the earth.

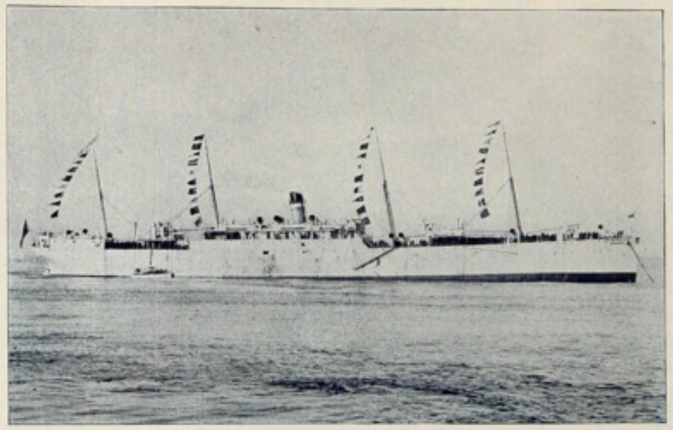
CRUISER BROOKLYN PASSING UNDER BROOKLYN BRIDGE.

TRANSPORTS OF THE UNITED STATES ARMY.

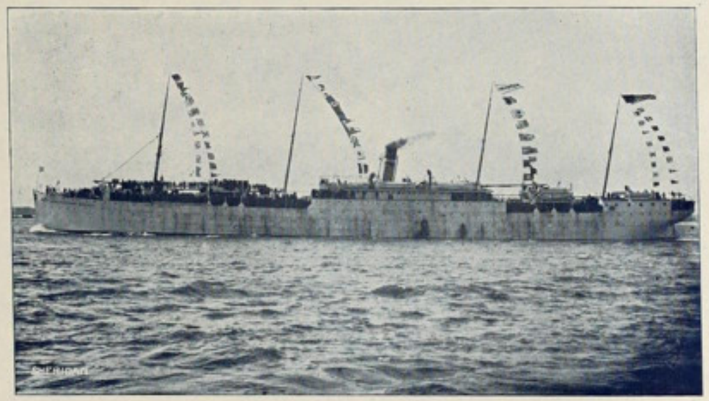


THE McPHERSON.

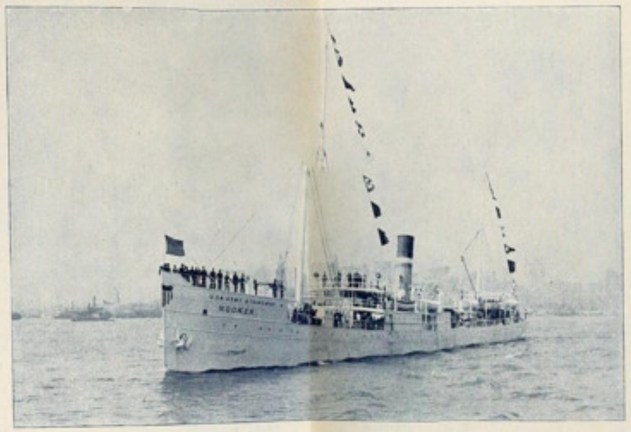
THE McCLELLAN.



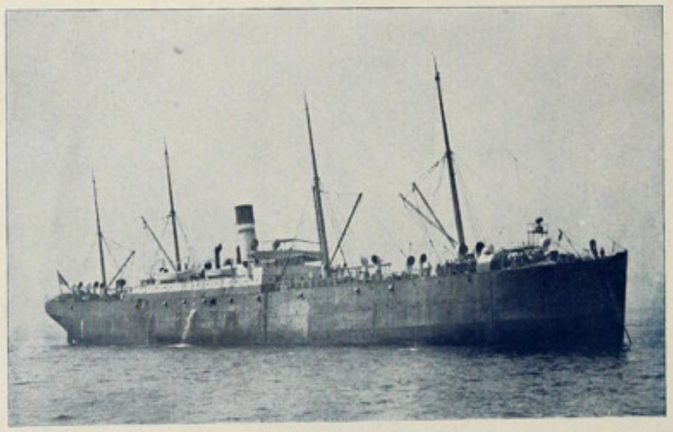
THE GRANT.



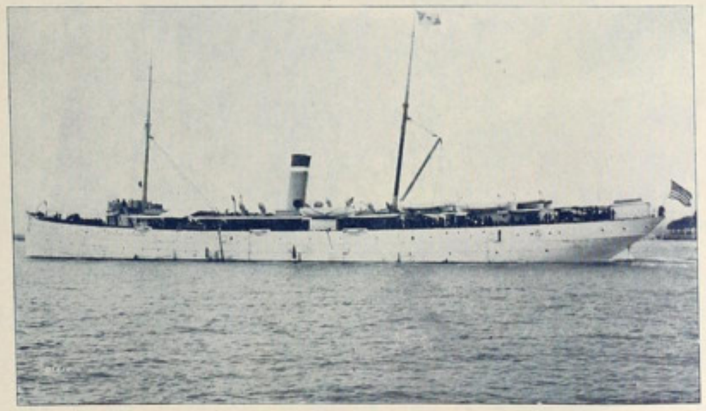
THE SHERIDAN.



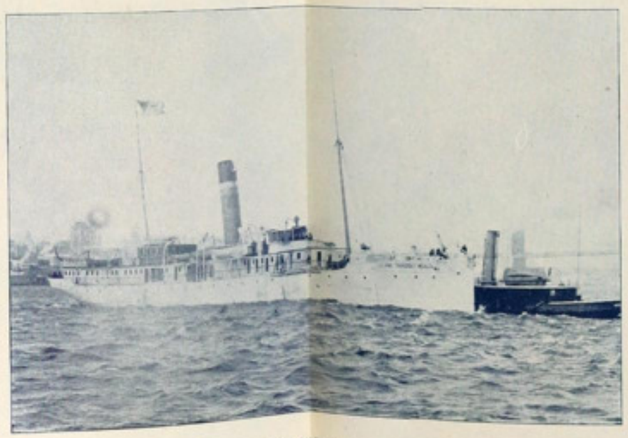
THE HOOKER.



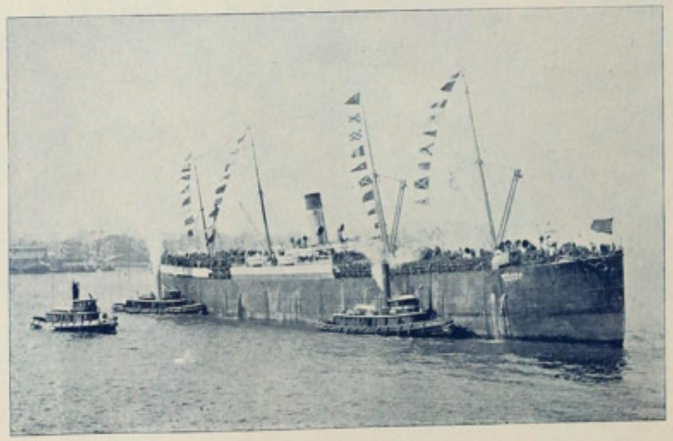
THE BUFORD.



THE DIXIE.



THE INGALLS.



THE LOGAN.

REAR ADMIRAL MELVILLE, CHIEF OF THE BUREAU OF STEAM ENGINEERING, ON THE NEW BATTLESHIPS.

The new United States battleships should be of at least 20 knots speed to be equal in this respect to foreign battleships of the latest type. They should carry very large batteries of rapid-fire guns. The experience of our government during the Spanish war developed the value of these guns and also developed the comparative uselessness of excessively heavy armor. Our new battleships should have triple screws for economic, as well as strategic, reasons. They should have very large coal bunker capacity. This in connection with triple screws would give them an unexcelled radius of action. Personally, I think that a main battery consisting of a large number of 10-inch guns, reinforced by as many 6-inch guns as possible, may be the best. Whatever armor we do have should be of the very best quality obtainable in this or any other country. It is to be noted that the tendency of naval design in these days is towards a ship for the line of battle which shall be an amalgamation of the types now known as battleships and armored cruisers. Our new battleships should therefore have nearly or quite the speed of armored cruisers together with the large coal capacity of these ships, as well as a maximum gun power and as much armor protection as it will be possible to obtain without exceeding the limit of displacement fixed by the draught of water in our harbors and by the size of our dry docks. The ships will, of course, have water-tube boilers.

GEORGE WALLACE MELVILLE.

REAR ADMIRAL CHARLES O'NEIL, CHIEF OF THE BUREAU OF ORDNANCE, ON KRUPP ARMOR.

About 7,350 tons of armor are required for the three new battleships, now under construction, and the contracts should be awarded by Jan. 1, 1900. To defer the awarding of the contract longer would be likely to delay the completion of the battleships upon schedule time. Armor of good quality can be secured for $400 a ton, unless there should be an unexpected rise in the price of pig iron. Such armor is not the best obtainable, however, nor in the progress of events is it at all suitable for the new battleships. To use this armor would be to the lasting discredit of the United States navy, as we would suffer from the comparison of having a Russian battleship of American manufacture equipped with armor vastly superior to that which we place upon our own battleships. This disgrace will occur unless congress comes to our relief. The new process armor, known as Krupp armor, is now being commercially made in the United States. The first test of the service group of Krupp armor intended for the Russian battleship was made at Indian Head on Sept. 19, 1899. The navy test requires the plate to stand without cracking five shots with a velocity of 2050 feet per second from a 5-inch gun. The first shot was at a velocity of 2060 feet per second, the second shot 2082, the third 2057, the fourth 2099 and the fifth 2060. The penetration was 2 inches. Had the ordinary armor been used the penetration would have been 4.4 inches. Krupp armor should be used on our battleships.

CHARLES O'NEIL.

PAPERS TO BE READ AT THE SEVENTH ANNUAL MEETING OF THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS—NEW YORK, NOV. 16 AND 17.

Causes for the Adoption of Water-tube Boilers in the U. S. Navy. Engineer-in-Chief Geo. W. Melville, U. S. N.

Notes on Sheathing the U. S. S. Chesapeake. Naval Constructor Lloyd Bankson, U. S. N.

System of Work in a Great Lakes Ship Yard. Mr. W. I. Babcock, Chicago.

Novelties in Ship Fittings. Asst. Naval Constructor R. M. Watt, U. S. N.

Tactical Considerations Involved in Torpedo-boat Design. Lieut. A. P. Niblack, U. S. N.

Designs for the Denver Class Sheathed Protected Cruisers. Chief Constructor Philip Hichborn, U. S. N.

Life Saving at Sea. Mr. John R. Hyslop.

Coaling Vessels at Sea. Mr. Spencer Miller.

Electric Plants of the Battleships Kearsarge and Kentucky. Naval Constructor J. J. Woodward, U. S. N.

Progressive Speed Trials of the U. S. S. Manning. Prof. C. H. Peabody.

Large Ship Yard Appliances. Mr. James Dickie.

Beam Formulae Applied to a Vertically Stiffened Bulkhead, with some results. Mr. H. F. Norton.

"The Increasing Complications in Warships, and how simpler arrangements might be adopted." George W. Dicki .

WHAT CAPT. FOLGER, WHO WILL COMMAND THE KEARSARGE, SAYS OF THE SUPER-IMPOSED TURRETS.

The military principle of the double turrets of the Kearsarge is entirely correct and extremely effective compared with the battery arrangement of her predecessors in date of completion. The Kearsarge has a volume of fire in, say fifteen minutes of delivery, as follows:

Fire ahead to 20 degrees on each bow—20 per cent greater weight than the Oregon class and 33 per cent greater than the Iowa class.

From 20 degrees to 25 degrees on each bow—Slightly greater than Oregon or Iowa class.

From 45 degrees on the bow to 45 degrees on the stern—90 per cent greater than the two older classes.

It would be inexpedient to make any statement of the probable future performance of the vessel prior to her sea trials, but the most favorable results may be anticipated.

CAPT. W. M. FOLGER.

A DEEP WATER CONNECTION BETWEEN THE LAKES AND THE ATLANTIC IS THE GREAT DESIRE OF THE CHIEF OF THE BUREAU OF STATISTICS.

I hope the next great edition of the Marine Review will celebrate the inauguration of a system which shall connect the lakes with the ocean by a deep-water channel, thus making the great lakes practically a part of the Atlantic ocean and adding vastly to their already great value to commerce and to the country. There seems to me no good reason why that great chain of waterways, which now floats such a magnificent mercantile fleet, should not be so connected with the Atlantic that vessels carrying the products of the great grain and provision producing section bordering upon the lakes should load at the western lake ports and unload at European ports, loading again there with such of the products of the old world as are demanded by the people of the new, and discharging their return cargoes at their ports in the very heart of our continent. That a great chain of lakes reaching to the very center of our greatest producing and manufacturing area and capable of floating perfectly seaworthy vessels should by all means be connected with the ocean by a deep-water channel will, I think, be conceded by every student of international commerce and by every man having at heart the prosperity of the whole people of the United States.

O. P. AUSTIN.

NOTES ON OUR RECENT NAVAL PROGRAM AND DESIGNS,

WITH PARTICULAR REFERENCE TO THE INFLUENCE OF THE SPANISH WAR.

BY REAR-ADMIRAL PHILIP HICHBORN, U. S. N., CHIEF OF BUREAU OF CONSTRUCTION AND REPAIR.

That an educated and intelligent public opinion is necessary to the success of our form of government is a truism which is perhaps nowhere more strikingly exemplified than in the question of naval policies and programs. Using the words "policies" and "programs" in a broad sense, this is bound to be the case with any form of representative government; but the saying is peculiarly applicable to us, since congress in authorizing and appropriating for new construction fixes not only the number of ships with their maximum cost, but also the type, and, to a certain extent, the broad features of design.

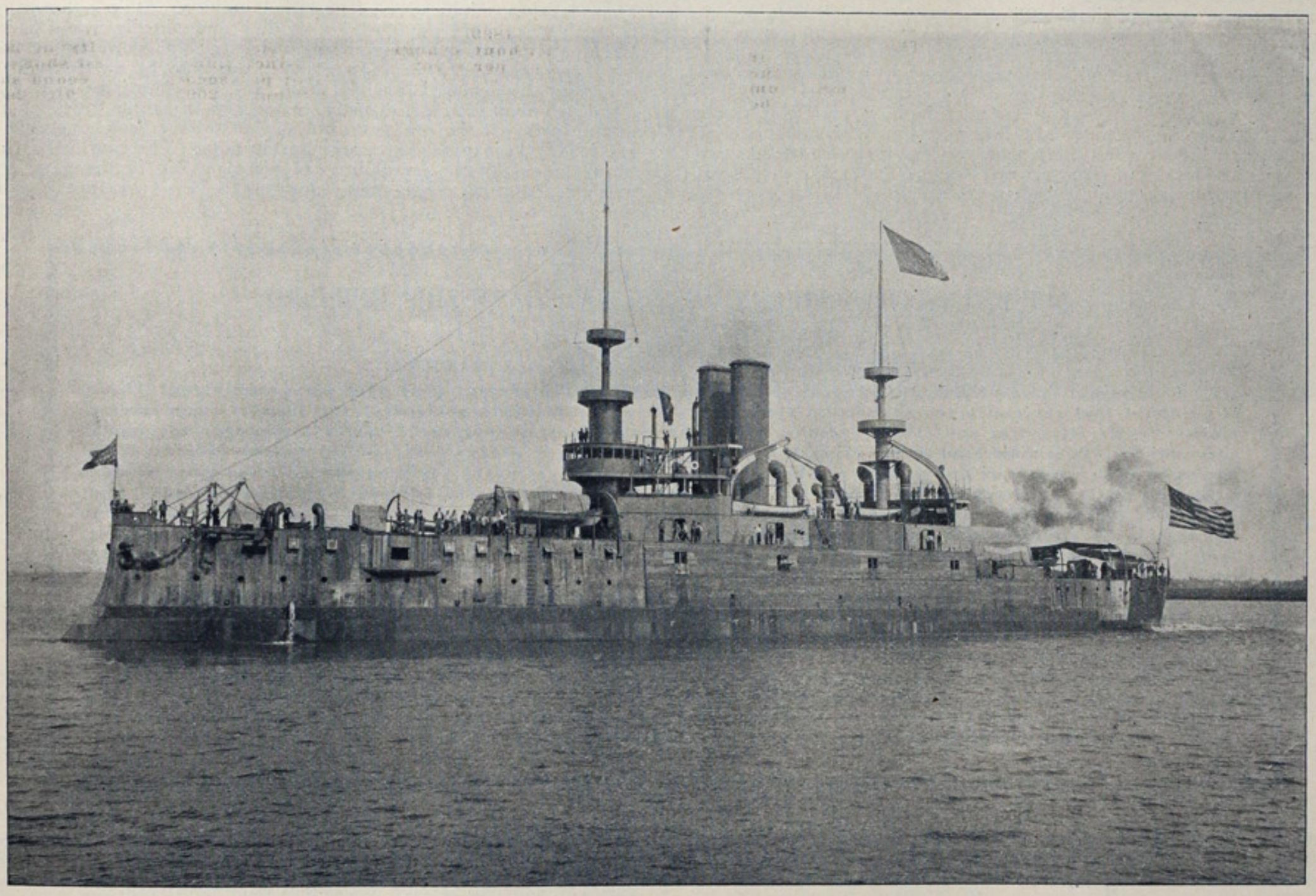
It is the principal object of this article to note the effects of the Spanish war upon what may be called "special public opinion," as reflected in our latest program, and upon expert opinion as indicated by the principal features of design now in favor. The limits of this article forbid any exhaustive treatment of the subject, and I shall have to content myself with pointing out only the salient and important features.

The program in question authorized "three sea-going coast-line battleships, carrying the heaviest armor and most powerful ordnance for vessels of their class upon a trial displacement of about 13,500 tons, to be sheathed and coppered, and to have the highest practicable speed and great radius of action, and to cost, exclusive of armor and armament, not exceeding $3,600,000 each; three armored cruisers of about 12,000 tons trial displacement, carrying the heaviest armor and most powerful ordnance for vessels of their class, to be sheathed and coppered, and to have the highest practicable speed and great radius of action, and to cost, exclusive of armor or armament, not exceeding $4,000,000 each; and six protected cruisers of about 2,500 tons trial displacement, to be sheathed and coppered, and to have the highest speed compatible with good cruising qualities, great radius of action, and to carry the most powerful ordnance suited to vessels of their class, and to cost, exclusive of armament, not exceeding $1,141,800 each."

The size of this program is satisfactory evidence of the fact that the war awakened the country to a realizing sense of the meagre number of vessels in the navy compared with the work it may be called upon to do. The war showed this clearly, and had the further effect of exploding an oft-repeated fallacy, namely, that when war threatened the navy could be easily increased the necessary size by the purchase of war ships, and the conversion of merchant craft. The latter idea was undoubtedly erroneously derived from our Civil War experience, and took no account of the vast strides in naval architecture since that time.

It will be remembered that previous to the actual outbreak of hostilities every effort was made to purchase completed war vessels abroad, with but little success, the New Orleans, formerly the Brazilian cruiser Amazonas, being the only efficient vessel secured.

We bought merchant vessels, it is true, but it took time to convert them for service, and many were almost wholly unsuitable, though probably the best that could be obtained. With a few exceptions, we did not have merchant steamers under our flag which lent themselves readily or which were designed originally with a view to converting into auxiliary men-of-war. Under the circumstances, the array of auxiliary vessels turned out from our yards in a comparatively short time was highly gratifying, the work of conversion falling largely upon the construction bureau; such work consisting of arranging quarters, magazines, etc., mounting guns supplied by ordnance, docking and painting, together with numerous alterations and repairs frequently necessary. As shown by the bureau's annual report, no less than 123 such vessels were converted for auxiliary purposes, including about twenty colliers and several distilling ships, supply vessels, refrigerating and ice ships, a repair ship, an ambulance ship, etc., upon which the bureau expended in alteration and equipping, particularly on the special classes mentioned, sums of from $25,000 to $100,000 each. Experience with these and the fast chartered steamers demonstrated, as was to be expected, that the merchant fleet is principally useful as a source of supply from which to draw vessels for special service, such as scouts, colliers, supply, repair and hospital ships.



AMERICA'S NEWEST BATTLESHIP THE ALABAMA PROCEEDING DOWN THE DELAWARE RIVER FOR HER TRIAL.
Built by Wm. Cramp & Sons Co., Philadelphia.

ADOPTION OF THE SHEATHED SYSTEM OF CONSTRUCTION.

Apart from the size of the program, perhaps the most striking, and to me the most gratifying feature, is the adoption of the "sheathed" system of construction. The bureau of construction has persistently and consistently advocated the adoption of this feature for years past, holding that the advantages gained in sustained sea speed, independence of docks, and diminished coal consumption, more than compensate for the increased cost and displacement involved. The engagement off Santiago demonstrated negatively the tactical advantages of the system. Had Cervera's fleet been sheathed and coppered, the additional speed at his disposal might have permitted the escape at least of the Colon. On the other hand, had this advantage been with our ships the affair would have been settled in shorter order than it was.

Aside from tactical advantage noted above, the demands upon the navy of any commercial nation in peace time require a fair proportion of cruising vessels of this construction. This demand is, of course, increased if the nation has outlying island territory. The six sheathed cruisers in the program under discussion, when added to the two purchased, New Orleans and Albany, and the six composite gunboats, will form an important division of our fleet, peculiarly fitted for service in distant waters. Speaking of the composite gunboats, reminds me that little has been said of the performance of the Marietta in making the trip around the Horn in company with the Oregon. While not as momentous, the results are equally creditable and gratifying, as are also recent coal consumption reports received from others of the class.

We come now to the important part of the program—the battleships

and armored cruisers—and note that in addition to the usual requirements as to protection and armament, congress especially calls for high speed and great radius of action, and that the displacements are correspondingly large, particularly in the case of the armored cruisers.

It has been demonstrated that the battleship and the armored cruiser are the craft to be depended upon where real fighting is to be done. The types are merging somewhat in so far as the battleship is being made speedier, has greater endurance, and has its armor more distributed, while the armored cruiser has probably reached its maximum useful speed, but is being built larger and more formidable. There is of course a well defined difference still in the heaviest armor and armament of the two types. As now designed, however, they are eminently suited to be associated in the same fighting squadron. The Brooklyn and Oregon made a pretty running fight in the chase after the Colon. The improved Brooklyns and Oregons of the future will be still better fitted for such work, and these are the vessels we are going to build hereafter and rely upon as our main line of defense and offense.

When the Oregon class was designed, the idea was to obtain vessels of medium freeboard amply protected and mounting a battery equal and probably superior to that of any vessel they might possibly be engaged with. They were intended for the defense of our coast, and speed and endurance were reasonably sacrificed in obtaining the smaller and less costly type. The development of the navy has caused us to expand this policy, while the progress of ship building art has been such as to permit it, without again reaching the contract price of over three millions on the ships of the Oregon class. We can now make and have made contracts for vessels 25 per cent larger and developing 50 per cent more power than the Oregon for considerably less money.

The performance of the Oregon was one of which we are of course justly proud; that of the Brooklyn was also very gratifying, although no more than was to be expected. The principal lesson taught by her performance was the efficacy of electrical machinery. Reports from officers of the vessel were unanimous in declaring the superiority of the electrical turret machinery, and the sentiment of sea-going officers seems beyond question to favor the extension of electricity to all auxiliaries, and it is believed that we are approaching this condition slowly.

OMISSIONS FROM THE NAVAL PROGRAM.

Before passing to the leading features of design not specified by congress, it will be well to devote a little time to the "omissions" from the program, a feature as significant of public and expert opinion as the program itself. We note first that no additional monitors are authorized. While this may be due in part to the fact that we are already fairly well provided with these vessels, built or building, still it is probable that the war experience in Cuban waters impressed upon the public the salient fact that their sphere of usefulness is limited. Certain qualities of these ships, such as low speed and freeboard, limited coal supply, and unsteadiness at gun platforms, are inherent to the type, and cannot be remedied without sacrificing the essential features of the design. These qualities render the monitor unfit for joint operations at sea with battleships and cruisers, and indeed prevent their putting forth their great offensive power under any other than smooth water conditions. They are, however, an ideal mobile harbor, not coast defense, and in the future will probably be reserved for this purpose. The passage of the Monadnock and Monterey across the Pacific was a notable incident of the late war, and gave a final demonstration, if any was needed, of their actual seaworthiness. The requirements of the situation in Manila bay were peculiarly well filled by these craft, and had the Spanish relief expedition under Camara ever reached Manila, Admiral Dewey would undoubtedly have appreciated and made good use of the monitors.

The omission of torpedo craft from the program is partially due to the large number authorized in 1898, for there is no reason to doubt that torpedo boats still have a place in naval warfare, though they will probably never be taken quite so seriously again. Certainly the news that a small flotilla of destroyers had sailed from the Cape de Verde islands or that one had left Montevideo to intercept the Oregon would not again cause anything like consternation. The frequent breakdown of these vessels, the easy repulse of the Terror by the St. Paul, the clever finishing of the Furor and Pluton by the converted yacht Gloucester, showed almost conclusively that this weapon is not to be feared greatly under ordinary circumstances. A surprise by a large fleet of boats, even in daylight, might produce results, as might the dash of a flotilla at night. The success of an individual boat, considering the attacked party to be duly watchful, is subject to a small chance. Torpedo vessels are small units, however, each capable of inflicting immense damage should its opportunity come, and they will continue to be built for this reason. Probably they will be relied upon more for defense than attack, however.

Our own torpedo boats, such as were in commission, were used, under compulsory circumstances, on service for which they were not designed—as gunboats on the blockade. As torpedo boats they had no opportunity to demonstrate their value. One, engaged in what was for us the most disastrous naval event of the war, was taken by her plucky commander to face the unknown quantity of defense inside the harbor of Cardenas. The little Winslow received about all the punishment she could withstand. She represents one of the earlier types, designed in the bureau. There is reason to believe that her commander was eminently well satisfied, even under trying conditions, with the performance of this boat, which cost less than $100,000.

THE SPECIAL DESIGNS IN VESSELS OF WAR.

The presence in a naval program of "special" designs, intended to magnify and make all important and irresistable some one feature of offense, is always indicative of unsettled opinion. It is noteworthy that no such vessels are provided for, as they undoubtedly would have been had they performed any important and successful work during the war. These special designs are represented in our navy by the dynamite vessel Vesuvius, the armored ram Katahdin, and the submarine boat Plunger. The first was useful as a dispatch vessel, and had some little opportunity to bombard; but the results do not appear to have been conclusive, damage having been great but markmanship poor. The ram had no opportunity to exhibit the possibilities of her type, but in the naval engagements which took place there appeared to be no attempt at ramming tactics, although had Cervera's fleet been differently handled, ramming might possibly have been resorted to. Observation of manoeuvres and study of the subject in recent years would indicate, however, that the vessel on the offensive in the case of an attempt to ram may frequently be exposed to the greater danger. While the opportunity for ramming may at times present itself, a vessel having a powerful ram as practically its only weapon, is believed to be of doubtful utility, particularly in an offensive war. The submarine boat Plunger has never been completed, and hence has had no opportunity to demonstrate its qualities. Recent events would indicate, however, that there may be a future for this type of boat.

Returning now to the question of the features of design of the new vessels not specified by congress, a few important features upon which light has been thrown by recent events deserve mention. Not the least important of these is the question of protection against fire. What is to be expected in action in the case of a vessel having inflammable wood in her construction, was thoroughly demonstrated on the Spanish ships at Santiago and Manila. Probably nothing was more demoralizing to the crews of these vessels than the fires which were started in many places and soon got beyond control. The effect is furthermore disastrous just as in the case of a non-fireproof building with a steel skeleton or framework. The heat developed soon distorts and destroys the integrity of the steel structure. The bureau of construction began the effort to render our ships fireproof even before results of the battle of the Yalu between the Chinese and Japanese fleets were made public, and has made substantial progress along the lines of improving the fire extinguishing apparatus, reducing the wood used to the lowest possible limit, and fireproofing such wood as is indispensable.

HIGH STEAM PRESSURES REQUIRE WATER TUBE BOILERS.

The increase in the speed of large vessels requires additional power, to obtain which without over-reaching machinery weight allowances, it is, of course, necessary to use high steam pressures, for which purpose it is advisable and almost essential to use the water-tube type of boiler. This system has the additional tactical advantage of permitting the rapid and safe raising of full steam pressure from cold boilers. The importance

BUILDER OF THE OREGON ON PACIFIC COAST SHIP BUILDING.

IRVING M. SCOTT,

GENERAL MANAGER UNION IRON WORKS, SAN FRANCISCO.

The possibilities of ship building on the Pacific coast at the present time open up a vast vista. There is no doubt that the enormous population along the shores of the western coast of the Pacific ocean offer a market for fruits, grain and other products, which the conditions on our coast make it possible to supply successfully. This must lead to the necessity of providing means of conveyance, and the Pacific ocean will be equipped with vessels as fine and as numerous as now cross the Atlantic. With many millions more people to supply with our products, as well as the Philippine islands, South Sea islands, Hawaiian islands, and Australia, the demands for ships will be unprecedented in the history of our coast. If our people are wise and grasp the situation and control the means of supplying the demand and the market, all the present facilities will be taxed beyond their capacity, which will encourage development along the entire Pacific coast to the great benefit of the people of America.

Oregon pine, a wood splendidly adapted for ship building, is easily obtained, and existing conditions of this kind tend to the development of the ship building industry. The mild climate, immense production of cereals and citrus and other fruits make living extremely cheap and enable the workman to continue his labors the year round, which tend in a great measure to offset the disadvantages that exist on account of the absence of good coal. Our coast abounds in quantities of good iron ore, ranging from the very highest to ore of medium quality. Our forests are full of charcoal, and an increase in ship building will put this charcoal on the market to supply the demand. Taking everything into consideration, ship building on the Pacific coast holds out the most charming and alluring prospects for the future.

of this feature was clearly illustrated at Santiago, where every moment gained by our ships in getting full steam power would have been of vital importance. The adoption of this type of boiler for the Illinois class was advocated by the bureau of construction, but was successfully opposed by some who are now foremost in favor of this feature.

The explosion of some Spanish vessels of above-water torpedoes, through fire or shot, gave a final demonstration of the danger of this form of installation. The submerged torpedo tube is an improvement which we have been too slow to adopt, but which is now embodied in our latest plans. It has been recognized for several years that this is the only satisfactory installation, and while it may have been wise not to attempt it until the method of under-water discharge should become in some degree perfected, yet it would probably have been better in the meantime to have omitted the installation altogether, particularly on the ships of the Kearsarge and Illinois class. I was opposed to the fixed stem and stern tubes almost from the beginning, and anticipated the work that we have been doing for the last year or two in removing these tubes from vessels which might very well have been without them in the first place.

The war confirmed previously-held opinions that the rapid-fire gun using smokeless powder and efficiently served from protected positions, is capable of enormous damage, and the future will probably see an extended use of this weapon. The 13-inch gun seems to have had its day, and we are following the lead of European nations in making the 12-inch our heaviest gun. The bureau has been persistently advocating this for several years, and preferred the 12-inch for the Kearsarge and Illinois class.

It may not be out of place to conclude this brief review of the history of our recent naval program and designs, with a few words on an allied and important subject, namely, our facilities for docking and repairing vessels. The lack of docking facilities at the time of the war was painfully apparent to every one, and might have embarrassed us sorely. It is important that we should have docks at an early date, that they should be of ample capacity and proper design, and that they should be well placed, with facilities present for doing work, obtaining material, and mechanics, etc. Our navy yard plants at the principal stations at least, were in fair shape for doing work, but it would be unwise indeed if we failed to maintain and improve them as circumstances require. It is only in recent years that they have recovered from the neglect—through lack of appropriations—which followed the civil war. In fact, it was not until building work was authorized at the principal yards that the plants were brought into a condition for doing work on modern construction.

OUR NAVAL EXHIBIT AT PARIS.

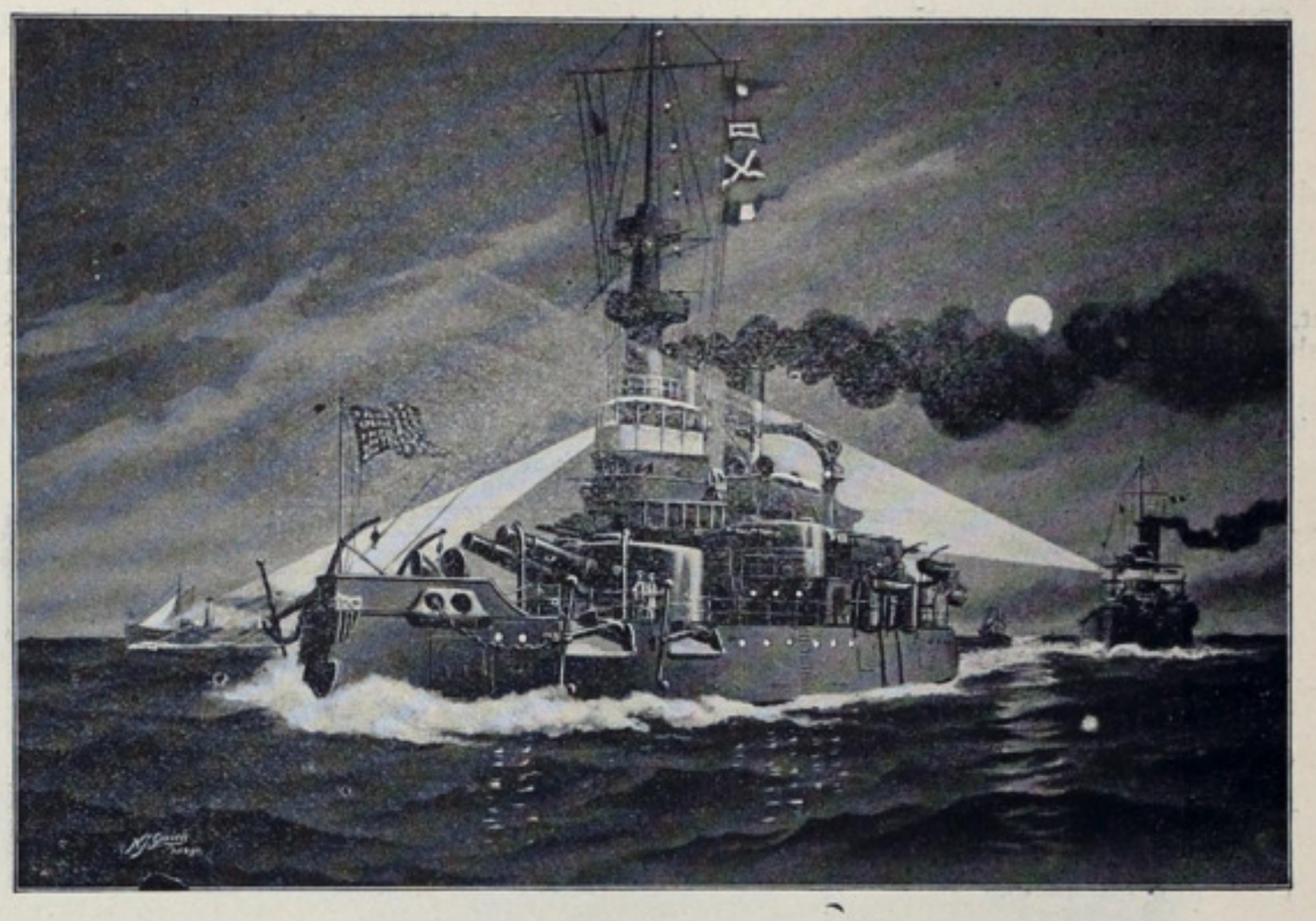
THE DISPLAY AT THE COMING EXPOSITION WILL BE OF A VERY CREDITABLE KIND--MODELS OF THE DIFFERENT CLASSES OF SHIPS.

The naval exhibit at the Paris exposition will be the delight of Americans and the admiration of all Europeans. Indeed it is doubtful if there will be anything at the exposition which will attract as much attention as the models of the vessels which destroyed the Spanish fleets at Manila and Santiago. Of course models have not been made of all the ships which were in those engagements, but the classes are all represented. These ships are now on exhibition in the corridors of the navy building and they are the center of attraction for all visitors.

All the models were constructed in the navy yard at Washington and are an exact reproduction of the vessels they represent in outward appearance. The greatest care has been exercised to preserve even the faintest detail and they are all built to a scale. Looking at them one may see all that he could possibly see in the battleship itself. These models have been all over the world. When Japan began to think that it needed a navy and set about to build a navy yard, the Union Iron Works, at its own expense, sent a model of the Olympia to Japan and the Cramps sent models of the New York and Indiana. The models were at the world's fair in Chicago, the expositions in Atlanta and at Philadelphia. The model of the Charlestown has been twice to expositions on the Pacific coast.

Doubtless the most attractive model at the Paris exposition will be that of the Maine. This model was made some time prior to the destruction of the battleship in the harbor of Havana. That disaster has added much in interest to the counterfeit presentment of the battleship. Even now it is surrounded by crowds in the navy department. The navy will be represented by the following models at the exposition: Texas, Miantonomah, Nashville, Wilmington, Bancroft, Boston, Annapolis, Charleston, Yorktown, Illinois, Petrel, Maine, Wheeling, Vesuvius, Kearsarge and Katahdin.

The most unique model of all, however, will be that of the Illinois class of battleships in dry dock. The pressing need for more dry docks in order to take proper care of the ships of the navy led Admiral Hichborn to cause to be constructed a working model of a dock, believing that it would prove a most interesting feature. The dock has been built and it consists of an accurate working model on a scale of one-quarter of an inch to the foot or one forty-eighth of the full size. This model is constructed mostly of wood, but the inside is lined with brass plates brazed together in order to make it watertight. It is an exact reproduction on that scale of the timber dry docks which are to be built at the Portsmouth, Philadelphia and Mare island navy yards, and in size and general dimensions of the new dry dock at the Boston navy yard, which latter, however, is to built of concrete. These will be 700 feet long on the coping head to the outer gate sill; 162 feet 6 inches wide on top; 71 feet wide on the bottom; 70 feet wide at the entrance on the bottom; 120 feet wide at the entrance on top; 38 feet deep to the\working floor and the top of the 3-foot keel blocks will be 30 feet below the mean high water line. The model has been prepared in great detail so that the model ship which accompanies it can be docked and undocked just as the actual ship would be. A large basin is constructed outside the entrance, in which the model ship will be floated, and a complete system of piping and valves is provided, so that the dock can be flooded, allowing the model ship to enter, and then when the dock is drained she is left dry on the blocks. A railing surrounds the three land sides of the dock, on which is a working model of a powerful traveling crane, used for handling heavy weights (400 tons being the capacity), which may need to be taken aboard of or removed from a ship in the dock. The ship model, which is part of the exhibit, is an accurate reproduction on the same scale of the battleships Illinois, Alabama and



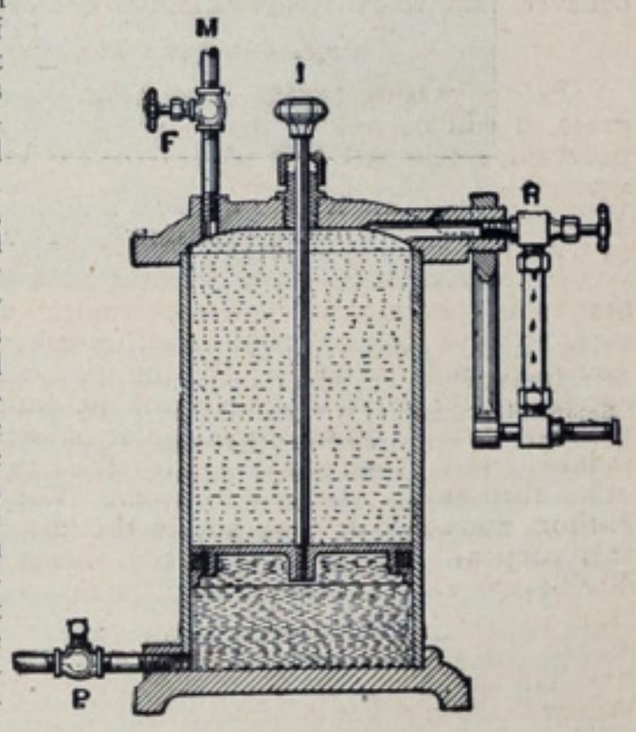
From a Painting by Nicholas J. Quirk.

OREGON AND IOWA ON THE PACIFIC.

Wisconsin. These ships are 373 feet 9 inches over all; 368 feet long on the water line; 72 feet 6 inches wide and 23 feet 6 inches draught of water, with a normal displacement of 11,525 tons, and with 10,000 indicated horse power, giving an estimated speed of 16 knots. Their total coal capacity is 1,200 tons. They carry four 13-inch guns in turrets 13 inches thick, and fourteen 6-inch rapid fire guns behind casements of 6-inch armor. The side armor extends from the stem 278 feet aft and is 16½ inches thick tapered at the forward end to four inches. The conning tower is 10 inches thick and the armor deck 2¾ inches thick amidships and 5 inches thick at the ends of the ship. They also carry a secondary battery of sixteen 6-pounder rapid fire guns, four 1-pounder rapid fire guns, one Gatling and one field gun.

THE HALL COMPOUND FEEDER.

This is one of those little economies which it is strange no one has thought of before and which the engineers will welcome at sight. Every engineer has often felt a perplexity as to whether he was wasting compound or was using too little and making scale in his boiler. The most he has been able to do has been to put a stated quantity of compound in his boiler at regularly recurring periods and find out by observation how long it would last. With this apparatus on the suction of his feed pump, he can handle his compound intelligently, and economically feed his compound with every gallon of water. Engineers using the feeder have had cleaner boilers with from two-thirds to one-third of the quantity of compound. One instance is recorded of clean boilers with one-fourth of the compound formerly used in the plant, but this is an exception. The company states that a saving of 40 per cent of the compound is a conservative estimate of the saving to be effected in the average plant.



The appartus consists of a reservoir with a tight-fitting plunger and connections at top and bottom for water and compound. The compound is placed above the plunger, which is lowered for the purpose, and the water is then admitted below the plunger and maintains a steady pressure on the compound. This causes it to drop through the sight-feed in the manner familiar to engineers with all sight-feed apparatus for feeding oil. Any compound may be used. The Atchison, Topeka & Santa Fe and the Chicago, Rock Island & Pacific railways are trying these feeders and will undoubtedly adopt them, and they are also in use in many stationary plants. For further information address the Hall Compound Feeder Co., Marquette building, Chicago.

AMERICAN LINERS AS AUXILIARY CRUISERS IN THE SPANISH-AMERICAN WAR.

BY CAPT. W. G. RANDLE,
COMMANDER OF THE ST. LOUIS.

Regarding the work of the American liners as auxiliary cruisers during the Spanish war, I can only report on the service rendered by the St. Louis, which will answer respectively for each of the four ships. The St. Louis went into commission on April 24, 1898, and remained in commission until Sept. 2, 1898. Her armament consisted of eight 6-pounders and four 5-inch rapid fire guns. The complement of ammunition for these guns amounted to 100 rounds for each 5-inch gun, and 500 rounds for each 6-pounder. The gun's crews were composed of the following: Seamen and marines, four to each 6-pounder; seamen and marines, six to each 5-inch gun; captain chosen from best men.

The time taken to get full speed from cruising speed was eight minutes. Roughly, the number of miles traversed during commission was 17,782; amount of coal consumed, 11,620 tons; consumption per indicated horse power, 1.41 pounds; total coal storage, 5,000 tons; total capacity for troops, 1,292; total capacity for stores, 23,569 feet of cold storage. The prizes taken were one steamer with 4,000 tons of coal for the Spanish fleet, and two sailing vessels with provisions for Spanish army.

The ship's company consisted of the following: The original ship's company retained in all departments and naval commissions as noted herewith given to officers: Captain, commander's commission; chief officer, lieutenant's commission; three second officers, lieutenant's commission, junior grade; third and fourth officers, ensigns' commissions; chief engineer, chief engineer's commission; two first assistant engineers, passed assistant engineer's commission; two second assistant engineers, assistant engineer's commission; three third assistant engineers, assistant engineer's commission; four fourth assistant engineers, warrant machinists' commission; doctor, assistant surgeon; purser, assistant paymaster; boatswains, carpenters, quartermasters, masters-at-arms, seamen, firemen, stewards and cooks all enlisted on naval articles.

The total of the ship's company was 300, not including one naval captain, one naval lieutenant commander, one naval lieutenant, one naval ensign, one lieutenant of marines and fifty marines.

The first duty on which the ship was ordered was that of looking for the Spanish fleet from April 30, 1898, to May 12, 1898, with orders to report, if seen, to the navy department at the nearest cable station or to the admiral of fleet, and then to follow the movements of enemy's fleet. Afterwards we were detailed by Admiral Sampson to proceed to Santiago, Cuba, on May 15 to cut the cables leading from there to Jamaica and other points. On the 18th of May were engaged with the batteries from 5 o'clock in the morning until 2 o'clock in the afternoon, while grappling and cutting cables, which we succeeded in doing and withdrew from fire.

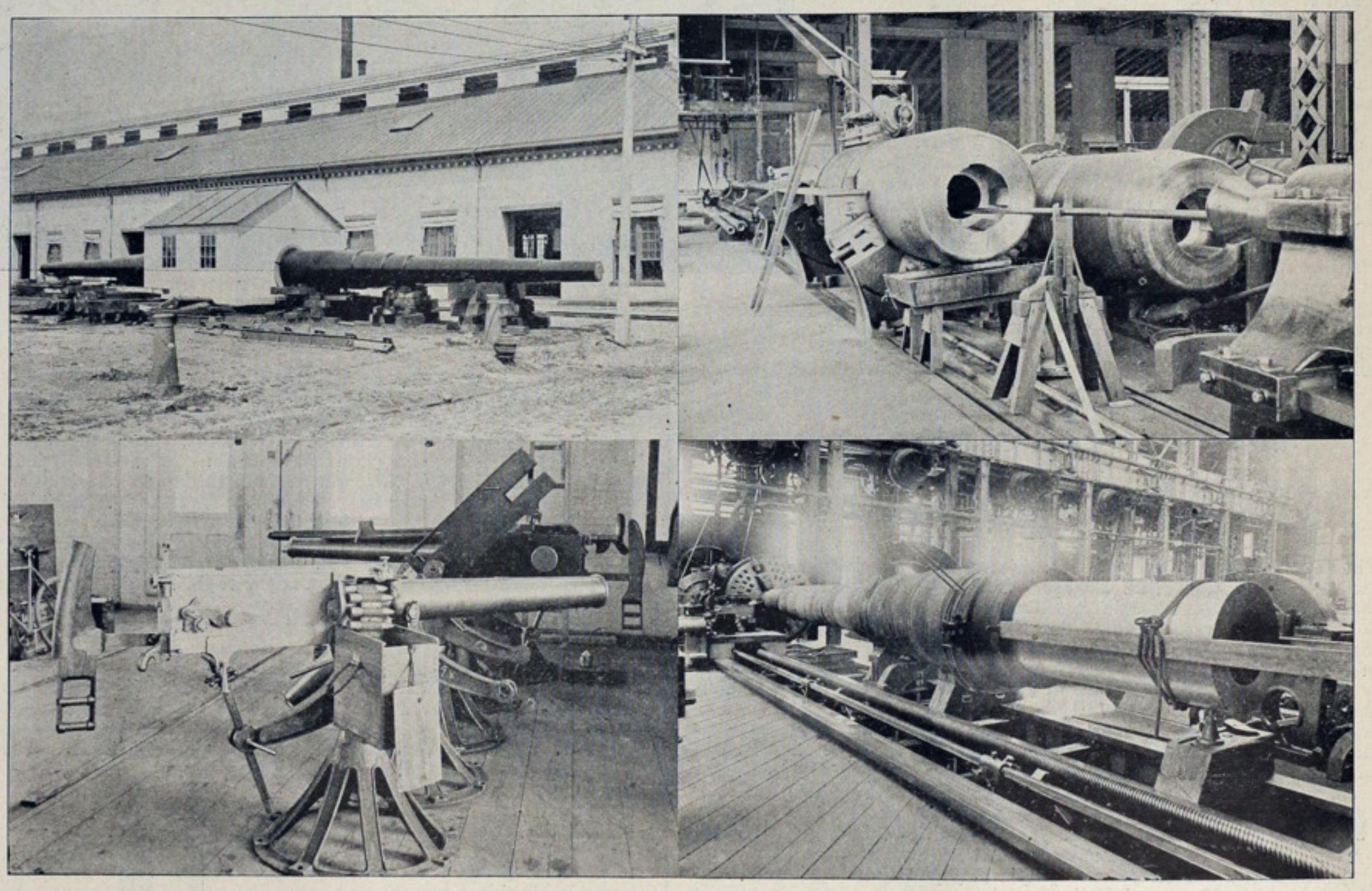
On the 19th proceeded to the harbor of Guantanamo, and after being engaged by Spanish gunboats in the harbor and a number of riflemen on Fishermen's point, which was afterwards Camp McCalla, had to abandon the effort of cutting cables on account of the Spanish gunboats having heavier guns than the St. Louis was at that time armed with. Then proceeded to the south side of Porto Rico and grappled for the cables off Cape Cabarocca. After cruising south of Porto Rico for some days passed on to Saint Thomas, reported to the secretary of the navy and proceeded to New York for coal and stores.

I might here mention that on the second cruise of the St. Louis we left New York May 30, with 4,457 tons of coal, 800 tons of fresh water in double bottom, and three months' fresh provisions in cold storage, and were constantly under steam night and day: cruised 6,850 knots; performed all kinds of duties such as cutting telegraph cables under fire from forts, landing troops, carrying troops and prisoners, carrying dispatches, blockading Cuban ports, taking prizes, etc., and returned to New York July 18 with 98 tons of coal left and 100 tons of fresh water. Our lowest coal consumption per day was 30 tons, giving 4 knots speed; 50 to 60 tons giving 8 knots; 240 tons giving 18 knots, and 340 tons giving 20 knots.

The St. Louis was detailed by Admiral Sampson and General Shafter for superintending the landing of General Shafter's army at Daiquire and Sibony. On June 23 we used all the ship's life boats and rafts, twenty-four of them, landing a portion of General Shafter's army from transports at Daiquire. There were fifty soldiers in each life boat and 30 on each raft. We landed 8,000 in six hours. The same appliances assisted by fourteen naval boats and six steam launches, landed at Sibony 9,000 of our men and 3,000 Cubans in eight hours.

On July 4 we took aboard Admiral Cervera and all the surviving Spanish officers, and 700 petty officers and seamen as prisoners, and sailed for Portsmouth, N. H.; arriving at Portsmouth July 10, we landed all Spanish seamen and sailed for Annapolis with Admiral Cervera and the Spanish officers, who were landed there July 16. The ship then proceeded to New York for coal and stores, arriving on the 18th; coaled and sailed, taking in 4,200 tons; arrived at Hampton Roads July 22, laying at anchor until the 28th; at 9:30 a. m. began receiving on board the Third Illinois infantry and camp equipage, also General Brooke and staff, 1,292 in all. At 1 p. m. all were on board and we sailed for Guanica, Porto Rico. Arrived there on the 31st and proceeded to Ponce; communicated with General Miles and proceeded to Arroyo. Next day, Aug. 1, landed General Brooke and staff and all troops under cover of our guns, as the Spanish troops made an advance from Guayamas. Repulsed the advance with our guns, and troops made a successful landing in four hours. On Aug. 4 we sailed from Arroyo for Ponce, Guantanamo and Santiago, landing stores and mails at each place. On Aug. 10 we sailed from Santiago with portions of three regiments of United States soldiers invalided home to Montauk Point, 900 in all.

It gives me pleasure to submit the foregoing and I hope it will be both interesting and instructive.



ADJUSTING BREECH MECHANISM OF 13-INCH GUNS.
ONE-POUNDER MAXIM AUTOMATIC GUN.

RIFLING AN 8-INCH GUN.
SHRINKING THE HOOPS OF A 13-INCH GUN.

Scenes at the United States Naval Ordnance Factory, Washington, D. C.

UNITED STATES ORDNANCE FACTORY,

FROM DATA FURNISHED BY THE BUREAU OF ORDNANCE.

The ordnance factory in the Washington navy yard is worth the while of any man to visit; and while it is indeed a structure of comparatively recent founding it is one of the largest in the country. It is nearly a thousand feet long. In 1883 a bill was offered in the senate for the establishment of a government foundry. At that time the United States had no ordnance of any kind save the old cast iron ones which were the legacies of the civil war. In 1884 it was recommended to the senate that guns should be made of hydraulic-forged, open-hearth steel, breech loading, chambered, of calibre ranging from 6 to 16 inches and from 30 to 35 calibres long. The development thereafter was rapid. Today the United States possesses on its coast line 100 each 8 and 10-inch guns, nearly fifty 12-inch guns (all high power steel breech loading guns), and 200 12-inch breech loading mortars, principally of the forged, built up, all-steel type. The construction adopted for these guns and mortars consisted of tube, long jacket and several layers of hoops, the various elements being shrunk into place.

The struggle between the makers of guns of high pressure and the makers of impenetrable armor is still going on; and the end indeed is not yet. The largest gun in the navy, the 13-inch bore, was designed to penetrate any armor afloat, but there are so many objections to this gun that it is doubtful if any more will be built at the gun factory. It is of interest to note, however, how the big guns originated. The guns of the civil war were smooth-bore and fired a spherical shot. Their pressure resistance was low and the powers of penetration comparatively feeble. As armor increased in toughness and thickness it became necessary to devise some means to penetrate the sides of a vessel. By elongating and pointing the projectile its power of penetration was augmented, but to keep it head on it was necessary to make a change in the gun. This was done by cutting spiral grooves in the bore of the guns and putting projections on the projectile which engaged the grooves. Greater pressure was required in the gun, however, and to meet this severe condition the big guns were made on what is known as the "built-up" principle and of a length nearly three times that of the smooth-bore type. The working pressure of a 13-inch gun is 15 tons per square inch.

In the "built-up" gun the bore is formed by a tube of accurate uniform diameter and then several layers of hoops or bands are shrunk on by making each part somewhat smaller than the one it embraces, expanding it by heat and allowing it to cool in its place in the gun. The parts of the gun, beginning with the tube, are in a state of compression which decreases gradually outward until the outer layers are under tension. The pressure of the powder first overcomes the compression of the tube and then puts it under tensile stress, at the same time being communicated to the outer layers, each of which bears its share. The shrinkage or original difference in diameter between a hoop and the part on which it fits is so calculated that the tube is not compressed beyond its elastic limit, nor is the outer hoop under such tension that it will pass the limit of its elasticity.

THE MANUFACTURE OF BIG GUNS.

The foundation of the gun is a tube of uniform exterior diameter, which contains the powder chamber and the entire bore. A large sleeve, called the jacket, of about three-fifths the length of the tube, is shrunk on the rear portion of the tube and extends sufficiently far to the rear to contain the breech mechanism. Three layers of chase hoops are shrunk on the chase, or portion of the tube, extending from the jacket forward, and a locking band is screwed on the tube to hold the foremost chase hoop in place. The jacket is embraced by a layer of jacket hoops. The chase hoops interlock with the tube and with each other, thus preventing the forward portion of the tube from being blown apart from the rear portion. The jacket and forward jacket hoop are similarly interlocked; and a locking band is screwed over the joint between the series of chase hoops and the forward jacket hoop to lock them together, thus effectually preventing the gun from breaking through transversely.

GENERAL VIEW OF THE GUN SHOP AT THE WASHINGTON NAVY YARD.

A 13-inch gun weighs 145,000 pounds and the projectile which it fires weighs 1,100 pounds. The bore is provided with fifty-two rifling grooves, which decrease in width as they approach the muzzle. The grooves are straightforward at the rear of the bore, but gradually turn until at the muzzle they give the projectile one turn in twenty-five calibres. In the overhanging portion of the jacket is the screw box into which is locked the breech plug which closes the rear end of the gun. The breech plug is cylindrical in form and its surface is provided with a heavy screw thread. The thread is cut away in six equal spaces. The cylindrical surface of the screw box is correspondingly formed, so that in screwing the breech plug home it is necessary only to place the thread sections on the block opposite the blank spaces of the screw box and slide the breech plug clear in when a turn of one-twelfth will engage the two systems of thread and lock the breech plug in place.

The breech plug when on the screw box is supported on the plug tray, which swings on a vertical shaft secured on bearings placed on the rear end of the gun. The plug tray has a guide-way to receive one of the screw sections of the breech plug as the plug slides out of the screw box; and when the breech plug is entirely out of the gun it is locked on the tray and the latter swings on its shaft to carry the breech plug to one

side. All these motions are performed simply by turning the shaft that supports the plug tray by means of a worm wheel gearing and hand crank. On the shaft below the worm wheel is a wheel which first acts (as a gear wheel) on a rack fastened on the breech plug to slide the breech plug into the screw box and then acts (as a worm wheel) on a worm rack at the end of the gear rack to turn and lock the breech plug in place.

The principal parts of the gun are made from cast steel tempered in oil and carefully and repeatedly tested for tensile strength and elasticity. The hoops and jackets are cast solid and then a hole is bored through them to admit a mandrel, on which they are forged, to elongate and enlarge them.

In turning the partly built up gun to receive the next layer of hoops the gun is clamped to the face plate of the head-stock spindle and its muzzle is fitted with a plug, in which is a conical hole that fits over the dead center of the tailstock at the outer end of the guides. Rests or goose-neck supports are placed at intermediate points on the guides to take part of the weight off the gun. As the gun revolves the cutting tool with its carriage is moved slowly along the guides by a large screw. In turning the outer surface of one of the jacket hoops, the tool, in going across from end to end, travels twelve miles and occupies fifty-six hours' time in the operation. In turning the inside of the hoop, the hoop is clamped in ring-like supports fastened on the tool carriage and the tool is secured in an arm, or a mandrel or bar, clamped to the head spindle and supported on

LOOKING NORTH IN THE GUN SHOP AT THE WASHINGTON NAVY YARD.

the dead center. As the tool cannot move along the guides, the hoop is moved slowly past the tool by causing the tool carriage to move along the guides.

The outer surfaces of the tube, jacket and hoops are turned in the same manner, but the bore and inner surface of the jacket are finished by the use of boring heads or cylindrical heads having four center cutters fastened in their segments of wood, fitted in grooves in its surface, and when it is forced into the revolving tube or jacket by the boring bar on which it is carried the wood is squeezed, holding the head in the bore rigidly, compelling it to travel in a perfectly straight line while the cutter acts, thus insuring a perfect bore. So accurate is the work that the bore, although 32½ feet long, is not usually more than .002 of an inch out of a straight line.

In assembling the gun the tube is first bored and its outer surface finished; then the jacket is finished inside and shrunk on the tube. The shrinking of a jacket is an event in the shops and usually attracts a great deal of attention. The jacket is heated to a temperature of 600 degrees Fah. in a cylindrical furnace, built in a large pit 40 feet deep. Air, blown through a tubular furnace maintained at a white heat by the combustion of sprayed crude oil, is forced through and around the jacket for twenty-nine hours. The burning blasts of oil make a roaring that drowns voices; therefore the entire operation is directed by signals and without a word spoken. The tube has previously been placed, muzzle down, in the pit, and pipes are arranged to run water into the interior of the tube to keep it cool.

When all is ready the foreman claps his hands and motions upward. A crane, traveling on overhead tracks, raises and carries away the iron cover of the jacket heating furnace. A large crane now comes and by chains hooked to trunnions on a ring clamped to the end of the jacket, the huge jacket, 17 feet long and weighing 40,000 pounds, is raised from its casing. To see if all parts of the jacket are evenly heated to proper degree the foreman rubs the surface as it rises from the furnace with rods, composed of alloys that melt at certain known temperatures.

The jacket is now swung aside and a star-shaped gauge is thrust through its bore to see if the heat has enlarged it sufficiently to pass over the tube. The bore, if found to be correct, is cleaned out with canvas-covered swabs. The crane carries the jacket to the tube, over which the foreman by motion to the craneman, carefully centers it. Four men with asbestos gloves now steady the jacket as it slowly descends on the tube. The crane which handles the jacket can easily carry off the finished gun, and yet it possesses such delicacy that the jacket is centered within one thirty-second of an inch and is lowered at the rate of but one foot in a minute. After the jacket has cooled and shrunk on the tube, its outer surface is finished on the lathe and the hoops are shrunk on. The outer surface of each part is finished after it is in place on the gun.

The compression slope where the copper ring on the projectile enters the rifling grooves is formed by feeding in a reamer on a boring bar while the gun revolves. The reamer is a conical head, having four longitudinal cutters secured to ribs on the head. A larger brass ring on the head bears in the screw box, which, however, is not yet provided with its screw, and a smaller brass ring bears in the as yet smooth bore of the gun. The cutters, acting on the shoulder between the bore of the gun and the powder chamber, cut on the revolving gun until a gradual slope connects these parts.

The next operation is the cutting of the screw threads in the screw box. The gun is as before revolved by the lathe and a tool, whose point is the shape of the space between two threads to the screw, is screwed in the carriage of the lathe, and the carriage is moved forward by its screw about 1½ inches for every revolution of the gun on its axis. This motion, causing the tool to trace a spiral in the screw box, forms the thread. The six blank spaces in the screw box are cut out by a tool that reciprocates longitudinally, the gun being slowly turned, step by step, between the movements of the tool.

In the rifling lathe the gun is blocked up in line with the rifling bar and a rifling head is attached to the latter. The rifling head is cylindrical and fits the bore accurately. It carries four cutters in the shape of the rifling grooves. The rifling bar has a groove in its surface which has

just the twist desired for the rifling grooves, and a stationary pin, which engages the groove in the bar, causes it and the head to turn in the proper manner to form the rifling. When four grooves are thus finished, the rifling head is turned one fifty-second of a turn and four new grooves are cut. The key way in the top of the gun is cut when the rifling is being done by a small milling machine, mounted bodily on top of the gun. In this machine a horizontally-revolving milling cutter is fed by a screw to cut the key way.

The breech mechanism, which is made in a separate shop, is attached while the gun, carefully greased, lies out of doors. To avoid taking the gun into another shop, a little knock-down house is hooked together around the breech, while the mechanics, by electrically-driven tools, attach the breech mechanism.

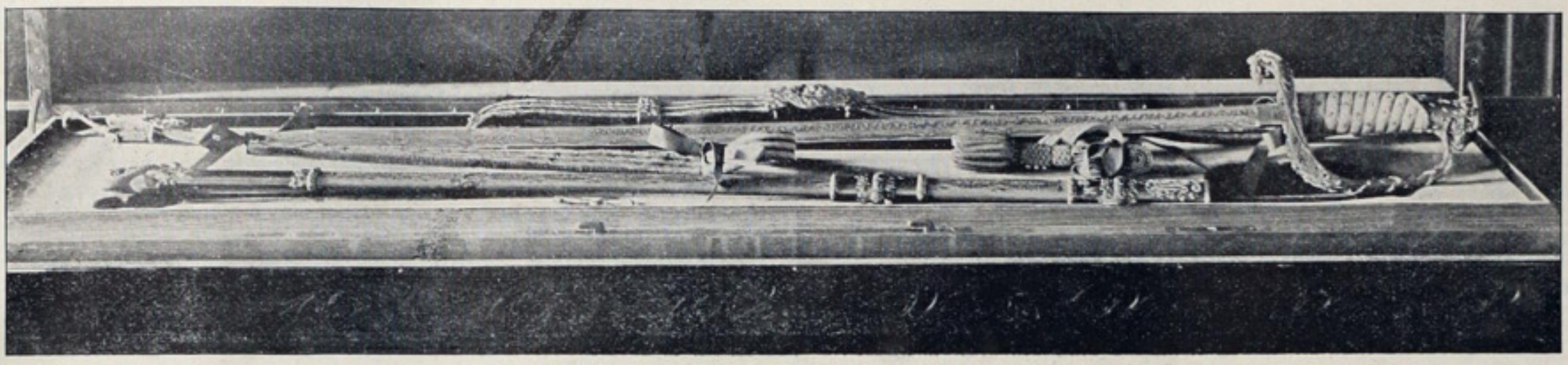
The finished gun is placed in the sleeve of its mount and all parts of the mount are put in place or else an equivalent weight is attached. The whose mass is now raised and placed on steel wedges, supporting the large lugs on the sides of the sleeve from which the trunnions are to be formed. These lugs are made sufficiently large to allow the trunnions to be so located as to perfectly balance the gun. If the gun is accurately balanced, the power necessary to elevate and depress it is comparatively small. The wedges are tried back and forth until, when finally placed, the gun muzzle can be raised and lowered by a slight touch of the hand. The officer can calculate the position of the trunnions within one-tenth of an inch. Weighing 145,000 pounds, it is as accurate in all its parts as a high grade watch.

The naval gun factory has a capacity of turning out 3,000 projectiles per day. The United States prefers the forged-steel, common shell because it will penetrate armor before exploding, whereas the cast steel shell, with thin walls but of high explosive power, is likely to explode on the outside of the armor.

DEWEY SWORD.

The sword which congress voted to Dewey and which will be presented to him on the Capitol steps on Oct. 3, is without question the handsomest sword on the continent. With the exception of the steel blade and the metal body of the scabbard it is made entirely of pure 22-carat gold. The grip of the sword is covered with fine sharkskin, which is held in place by gold wire and is studded with gold stars. Above the grip the handle terminates in an elaborately chased and enameled gold collar and pommel, a narrow band of oak leaves uniting the collar to the grip. On the pommel is carved the name of the battleship Olympia and the zoadical sign for the month of December, which is Commodore Dewey's natal month. These are encircled by a closely woven wreath of oak leaves, which are the standard decoration for a naval officer of Dewey's rank. At the top of the hilt are the arms of the United States, the blue field of the shield being in enamel. Below them are the arms of Vermont, the native state of the admiral. The guard is composed of a conventional eagle terminating in a claw clasping the top and the outspread wings form the guard proper. The eagle holds a laurel wreath in the beak. This, besides being symbolical, serves as a protection covering the point of the beak. The sword blade is of the finest steel and is damascened with the inscription: "The gift of the nation to Rear Admiral George Dewey, U. S. N., in Memory of the victory of Manila bay, May 1, 1898."

The blade is ornamented with Phoenician galleys and on the reverse of the lettered side are shown eagles in flight—symbolic of victory. The scabbard is of thin steel and is damascened in gold with sprays of a delicate sea plant. The sprays are interlaced so as to form a series of cartouches with stars in the center. At each side of the bottom of each cartouche is a dolphin. The lower portion of the scabbard terminates in entwined gold dolphins. Sprays of oak leaves and acorns secure the rings and trappings in the scabbard. The top of the scabbard is terminated by a raised monogram in diamonds, with the letters "G. D.," which are entwined, and below them are the letters "U. S. N." The cost of the sword was $3,000.

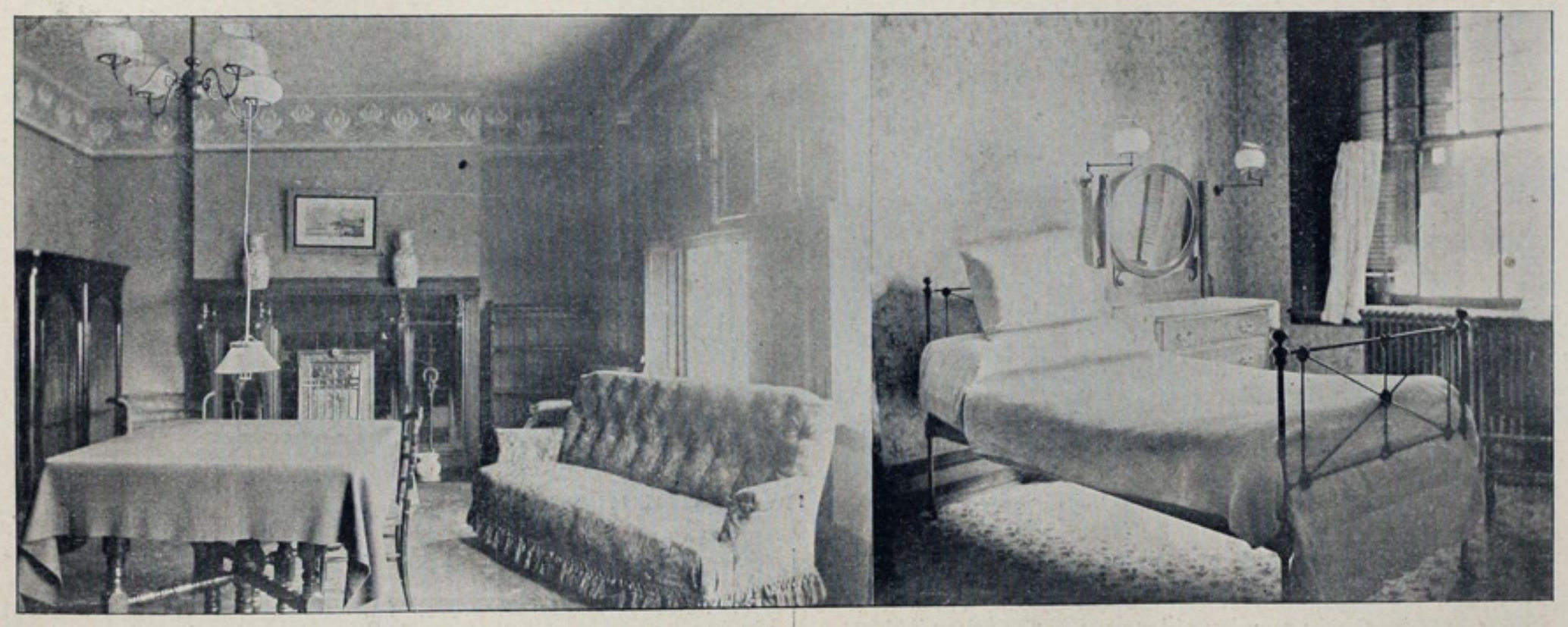


SWORD PRESENTED TO ADMIRAL DEWEY BY CONGRESS—HANDSOMEST SWORD IN AMERICA.

ADMIRAL DEWEY'S OLD APARTMENTS.

For several years Admiral Dewey lived in Washington at the Everett, an apartment house adjoining the Army and Navy Club. He occupied the two rooms shown in the illustrations—and unpretentious rooms they are. The sitting room, or den, is most modestly furnished, and the admiral was wont to spend his afternoons there, taking his usual nap between 2 and 4 o'clock. The bedroom adjoining is even more simple still. Upon the little bed shown the admiral slept during his five years residence in the house. He took his meals at the Army and Navy Club and every evening he dressed for dinner. Indeed the admiral was invariably one of the most carefully groomed men in Washington.

During the four days in which he will remain in Washington next week he will occupy sumptuously furnished apartments in the house which was built by Boss Shephard on the corner of Connecticut avenue and I street, and which is now occupied by the widow of Washington McLean.



ADMIRAL DEWEY'S OLD APARTMENTS IN THE EVERETT, ADJOINING THE ARMY AND NAVY CLUB, WASHINGTON, D. C.

ELECTRIC GENERATORS FOR TRANSPORTS.

The Bullock Electric Mfg. Co. of Cincinnati recently sold to the United States navy two 30 K. W. generators for the transport Meade and two 15 K. W. generators for the transport McPherson, as well as two 25 K. W. generators for the transport Logan. All are of engine type machine made by the Bullock company.

Manager D. E. Ford of the Superior Ship Building Co. says that no special obstacles have been encountered in the new dry dock that is under way at the head of the lakes. The delay has been due almost entirely to the long rainy season just closing, which caused the cutting away of slopes of the dock. If the weather had been of the ordinary kind, the dock would probably have been completed by this time. The work has been progressing very favorably and it is now probable that the dock will be ready for use by the early part of November.

OUR TORPEDO BOAT FLOTILLA.

BY WALDON FAWCETT,

OF THE MARINE REVIEW.

Until a few years ago the Americans in official positions whose enthusiastic interest made possible the speedy development of the "new navy" of the United States had given little thought or attention to the type of craft designed to bring out the fullest possibilities of the most destructive weapon of the age. Laggards they were, in a great measure from necessity rather than from choice. From the very outset our leaders in naval construction had new and novel ideas to embody in the different types of war vessels on which they were engaged, but in theories for the development of torpedo craft they were lacking. Unwilling to allow their policy to degenerate into mere imitation of European practice they waited.

But if retarded for a time in the beginning, the development of our torpedo boat flotilla may now confidently be expected to go forward at a pace that will more than compensate for the elapsed time. American naval officers have been studying the problems involved in the construction and management of the frail, high-speed craft. The Spanish war afforded them some tangible object lessons. Such conclusions as have been arrived at are based upon solid convictions, and the process of demonstrating their value before the world is now well under way in fourteen ship yards on the Atlantic and Pacific coasts of the United States.

The policy of the United States navy in this regard is in marked contrast to that pursued by many other nations. China and Japan, for instance, are accumulating fleets of torpedo boats of unexcelled speed, but from draughting-room to the details of outfit they are the work of foreign ship builders. Not a single suggestion have the officers who are to command them contributed, and efficiency of service may therefore well be called in question.

Compared with France, which has this year completed twenty-five torpedo boats and four destroyers, or Great Britain with a record probably even greater than that of France, the United States makes a poor showing. At the same time the condition of this branch of the service, and more especially the attention given to it of late, is in marked contrast with the meagre showing of a few years since.

When vessels now under contract are completed the full strength of the United States navy in this regard will be represented by sixteen torpedo boat destroyers and thirty-five steel torpedo boats, in addition to one submarine torpedo boat and one wooden torpedo boat. These half a hundred vessels have involved an outlay of between $6,000,000 and $7,000,000 and their complement will consist of upwards of 2,000 men and officers.

POLICY OF OUR NAVY WITH REGARD TO TORPEDO BOATS.

The policy of our navy with regard to torpedo boat construction is now very full and definite on every point. It declares unqualifiedly, first of all, in favor of crowned decks as giving more room and enabling more speedy coaling with less waste than would be possible with whaleback decks. Other special features bear evidence in the degree of thought given to the subject. The engine room is suggested, for instance, as the location for the steam steering gear in order to obviate the disadvantages arising from a long lead of steam piping with the inevitable heating and condensation. Copper is advocated for water tanks. To the towing arrangements especial attention has been given, in view of the fact that American boats, no matter of what type, must frequently be moved long distances from base to base; and there are also other distinguishing features, which are not mere matters of detail, but which need not all be enumerated.

The study of the torpedo boat problem has developed among American officers some very staunch champions of the value of this class of vessel. Even the general outcry which followed the failure of the Spanish war to demonstrate the usefulness of these vessels for the service for which they were intended, failed to shake faith in them. It may be mentioned in passing, also, that there could not well be offered any more conclusive evidence of the character of the American torpedo fleet in general than the service which it performed in this conflict. The torpedo boats, most of them, were utilized to a greater or less extent in dispatch and blockading service, and, considering the fact that they were originally designed for a totally different use, they served the purpose surprisingly well. Indeed the men in the engineering branch of the service are ready to contend that the feat of the Du Pont in accomplishing 12,000 miles of deep-sea steaming during the war and coming out of it with her machinery in good condition was a far more remarkable performance than the far-famed trip of the battleship Oregon around Cape Horn.

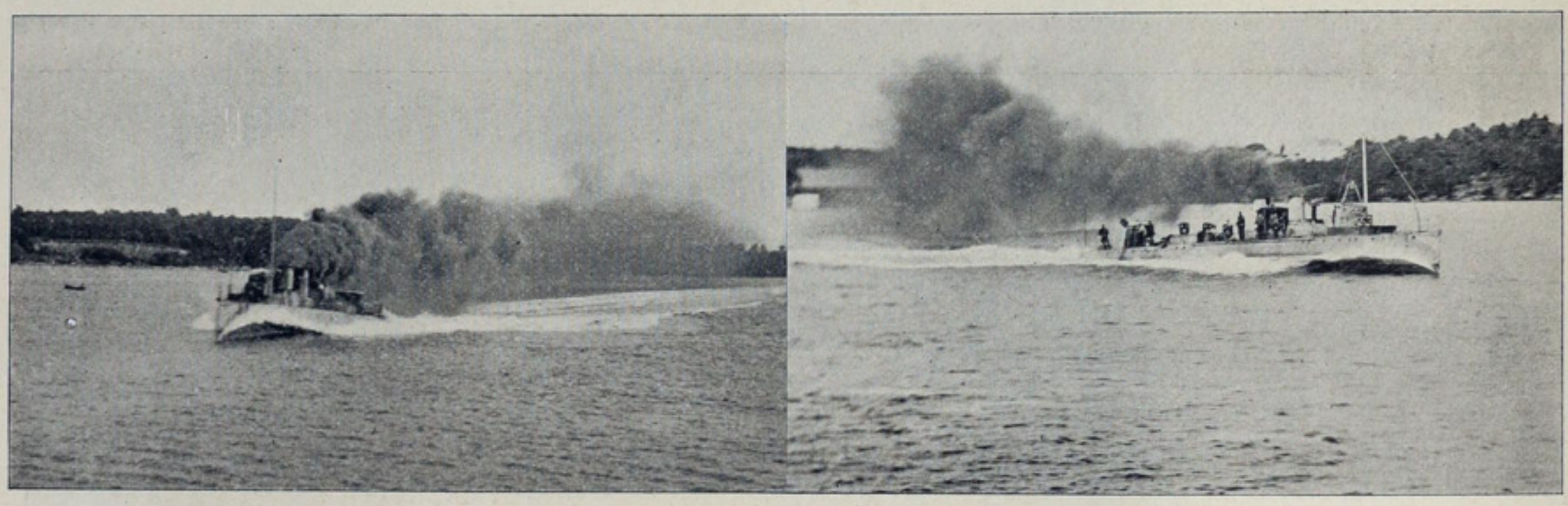
One of the reasons which commend to universal attention the earlier constructed torpedo boats of the United States navy is found in the fact that several of them were built by the world-famed Herreshoffs. "Nat" Herreshoff made a study of torpedo boat construction and evolved engines for light, high powered hulls long before he gave the subject of wind-propelled racing yachts any serious attention. Indeed we have the opinion of Lieut. A. P. Niblack, U. S. N., who has seen practically every torpedo boat in four or five foreign navies, expressed within the past year, that the DuPont and Morris—both products of the Bristol plant—are without doubt the two best boats of their type in the world. Herreshoff's success was not, however, due solely to skill in designing model and fittings. It may be attributed rather to a superb attention to details. This latter extended even to the training of special crews for the vessels constructed, and years after, when another firm of ship builders "borrowed" one of these crews, they dragged up to contract speed a boat which had a previous record of repeated failures.

It must not be supposed, however, that the DuPont and Morris, which each exceeded contract speed by a full knot, were the only torpedo craft of creditable performance. The Cushing exceeded her contract stipulation of 22 knots by half a knot; the Gwin made almost 21 knots when but 20 was required; the Porter showed 28.68 knots when her contract called for 27.5 knots; the Rodgers and Winslow were each a fraction of a knot in excess of exactions, and finally the Talbot developed a speed of 21.15 knots with engines that were calculated to give her but a 20-knot gait. Of the baker's dozen of boats of earlier construction, only two failed to meet contract requirements, and one of these, the McKee, could doubtless have done so had opportunity been given for further trial, but the exigencies of the Spanish war resulted in her acceptance by the government without the speed stipulation having been fulfilled.

ACHIEVEMENTS OF THE LATEST OF OUR TORPEDO CRAFT.

It is within the past year and a half that the achievements of torpedo boats of American construction have attracted attention. Foremost in the category is the accomplishment of three Pacific coast ship building firms—the Union Iron Works of San Francisco, Wolff & Zwicker of Portland, Ore., and the Moran Bros. Co. of Seattle, Wash. The Union Iron Works had never previously constructed a torpedo craft, while the two latter firms had never engaged in naval work of any kind. Yet these concerns produced in the Farragut, Davis and Rowan three torpedo boats that exceeded in each case the contract speed by more than a full knot.

The wonder of the year has been the showing made by the little torpedo boat Dahlgren, built by the Bath Iron Works of Bath, Me. Two stirring pictures—and the first to be published—showing the vessel making her wonderful bursts of speed, are presented herewith. The photographs from which they were reproduced were taken from the deck of the Annapolis. The Dahlgren is the most wonderful torpedo boat in the American navy. Indeed she is one of the most wonderful vessels of her kind in any navy. Her builders guaranteed a speed of 30½ knots on a displacement of only 150 tons. No other ship building firm in the world ever promised such speed on so small a displacement. The British 30-knot boats have twice this displacement, namely 300 tons, and all the other American 30-knot vessels, with the single exception of the Dahlgren's sister, the T. A. M. Craven—also building at Bath—have displacements varying from 250 to 400 tons. The Dahlgren with her length of 151 feet is little larger than the Foote, Rodgers and Winslow and yet her triple expansion engines are capable of developing full 4,200 indicated horse power, while 2,000 horse power is the best that can be gotten out of the other vessels referred to. Plans for this vessel are in a great measure original with the builders, although they worked them out from designs which Normand of Havre had made for the French torpedo boat Cyclone, a craft of 145 tons displacement and 29 knots speed. The steel worked into the Dahlgren is all galvanized and fully 40 per cent stronger than ordinary ship steel. The machinery consists of two triple expansion engines with cylinders 17, 25 and 37 inches diameter and a common stroke of 21 inches. The builders claim that the number of revolutions will be reduced materially by this stroke, which is from 3 to 5 inches longer than that of the ordinary torpedo boat engine. Thus, whereas 400 revolutions and 1,200 feet piston speed is accounted a fair showing for a torpedo boat engine, the engine of the Bath built craft turns but 340 revolutions when indicating 4,200 horse



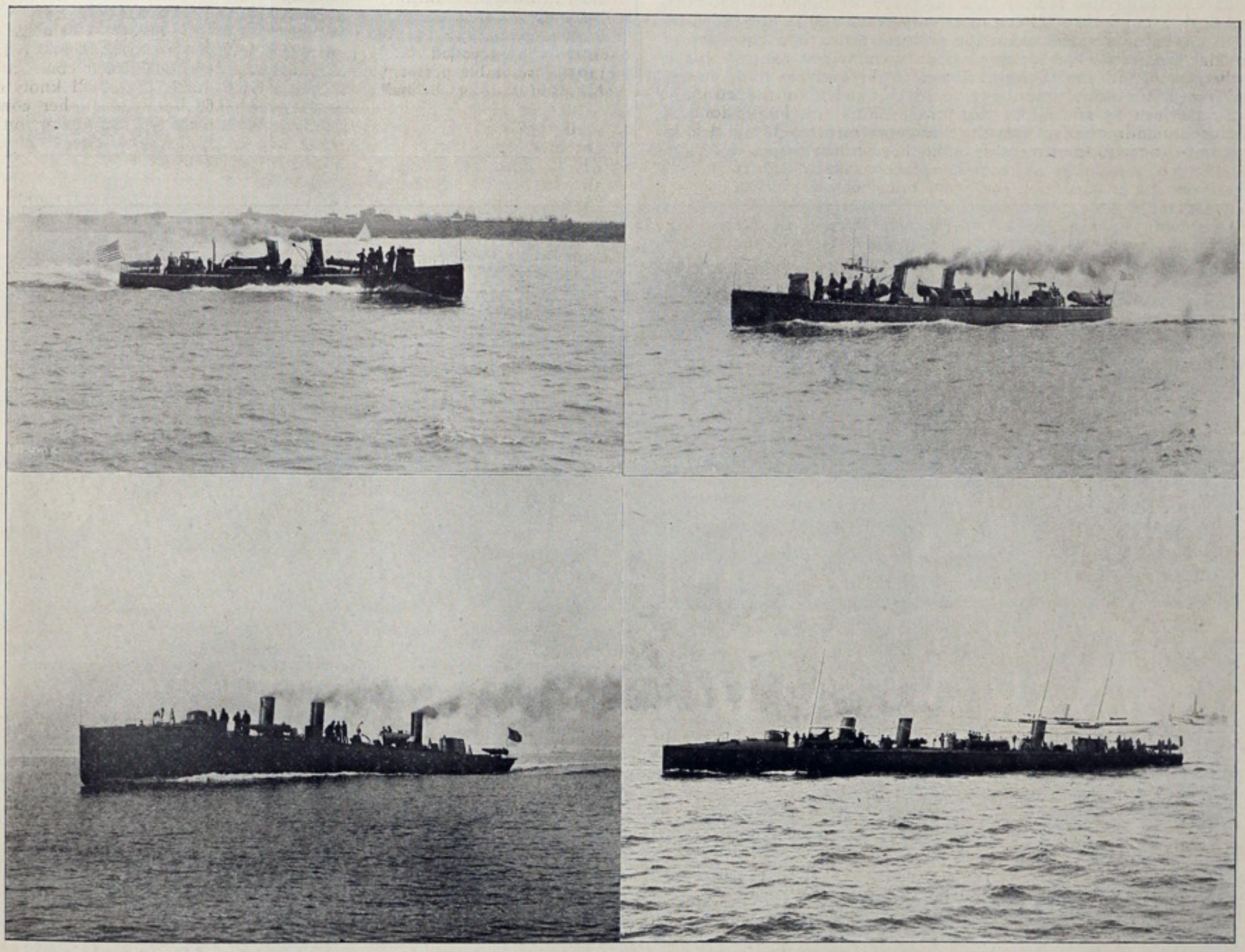
UP STREAM AGAINST THE TIDE AT 27 KNOTS. DOWN STREAM WITH THE TIDE AT 28 KNOTS.

The United States Torpedo Boat Dahlgren in Remarkable Bursts of Speed.

Photos taken from deck U. S. S. Annapolis.

power. In appearance, also, the Dahlgren differs widely from other American boats, a circumstance due no doubt in a great measure to her short, straight smoke stacks rising only just above the awning. The Dahlgren, it may be mentioned, has not, at this writing, had her official trial, but she has traveled at the rate of 31 knots in dead water and has averaged 30½ knots (her contract speed) for about 15 minutes, so that her ability as regards contract requirements can scarcely be called in question.

The present autumn will witness the official trial of another vessel of great interest to that portion of the naval public which concerns itself with the construction and operation of torpedo boats. The Stringham, just completed at the yard of the Harlan & Hollingsworth Co., Wilmington, Del., is, by virtue of her size, the flag ship of the torpedo boat flotilla of the United States navy. With her length of 225 feet she is fully 70 tons greater in displacement than the Farragut constructed by the Union Iron Works, San Francisco, and is fully twice as large as any other torpedo boat built or building for the United States government. In design the Stringham follows somewhat the British type of boat, but she is not by any means a close copy. A turtle back is built from the forward conning tower to the stern and the latter has a sharp rake instead of being plumb as usual. The Stringham is engined for 7,200 indicated horse power and she is expected to develop a speed in excess of 30 knots.



GWIN.
PORTER.

MACKENZIE.
DUPONT.

Flyers of the United States Torpedo Boat Flotilla.

NOT ALL ACCORDING TO GOVERNMENT PLANS.

Of the sixteen torpedo boat destroyers and nineteen torpedo boats now building five are in Pacific coast yards, while the remainder are under construction on the Atlantic. Some of the builders of these vessels have followed the plans prepared by the government, but others have made modifications in varying degree. Against this the advocates of standardization are protesting most vigorously, and not, it must be admitted, without considerable argument on their side, but the leeway given the builders will in the end prove deeply instructive by reason of the comparisons as to detail that will be afforded between vessels constructed under the same general specifications. As an indication of the extent of departure from government plans, both as to hull and machinery, there may be cited the case of the destroyers Truxtun, Whipple and Worden, building at the works of the Maryland Steel Co. at Sparrow's Point, Md. The official plans of these vessels contemplated a trial displacement of 420 tons, but it is expected that they will have a displacement of at least 433 tons on trial. All three of these vessels are of somewhat greater dimensions than contemplated by the navy department, but they are on considerably finer lines and will have at least 300 horse power in excess of the 8,000 specified.

A scarcity of steel is likely to interfere materially with the completion of the torpedo boats and destroyers now building. Several firms have already applied for an extension of time, in which to fulfil contracts. At the same time there is every probability that the close of the year will find a number of the new craft of this class in the water.

A feature of torpedo boat work in America to which considerable attention is now being given is the experiments with liquid fuel. No less an authority than Lieut. Commander William W. Kimball, U. S. N., who was in command of the Atlantic torpedo boat flotilla during the Spanish war, declared in a recent report that "there can be no properly constructed coal bunkers aboard torpedo boats and the real solution of the difficulty is to resort to liquid fuel." Preparations have been completed by the navy department for further trials of oil fuel on the torpedo boat Talbot, which has been equipped for the experiment at the Norfolk navy yard. The installation of oil apparatus on the Talbot consists of two large tanks, from which the oil is forced by compressed air through pipes to the furnaces. A special burner has been fitted under each boiler and it is claimed that by the use of one of these burners 160 pounds of steam can be generated in nine minutes from a perfectly cold boiler. The oil used is non-explosive, made from the refuse of oil refineries, and is consequently very cheap, it being asserted that its cost will not amount to 50 per cent that of coal. Another torpedo boat, probably the Gwin, will be similarly equipped.

The United States naval authorities have, as is well known, been giving attention for some time past to the claims of the submarine boat. They recently conducted trials on the Holland in the vicinity of New York, which proved quite successful, the boat being submerged and run for a mile under the surface. The submarine boat Plunger, building for the government at Baltimore and the completion of which has been so long delayed, is also likely to go forward now with little delay, as it has about been concluded to substitute internal combustion engines for the steam triple expansion type now fitted.

The navy department will not grant the applications for extension of time in the case of the contractors on torpedo boats. The delay in the completion of these vessels will be a year on account of the difficulty of getting steel. The firms have been advised that they may proceed with the work and it is implied that on the completion of the ships the penalties will be remitted, provided the delay has been caused by failure in the sources of supply.

According to Professor Ewing, eminent English physicist, "a Chinese navigator named Hoang Ti so long as twenty-four centuries before Christ used a magnet for navigating a fleet of ships. The form in which he is said to have used it was that of a fragment of lodestone, which was floated so as to be free to revolve. The mariner's compass of Chinese origin was first brought to Europe in the thirteenth century by a man named Marco Polo."

ESTABLISHMENT OF AN AMERICAN MERCHANT MARINE.

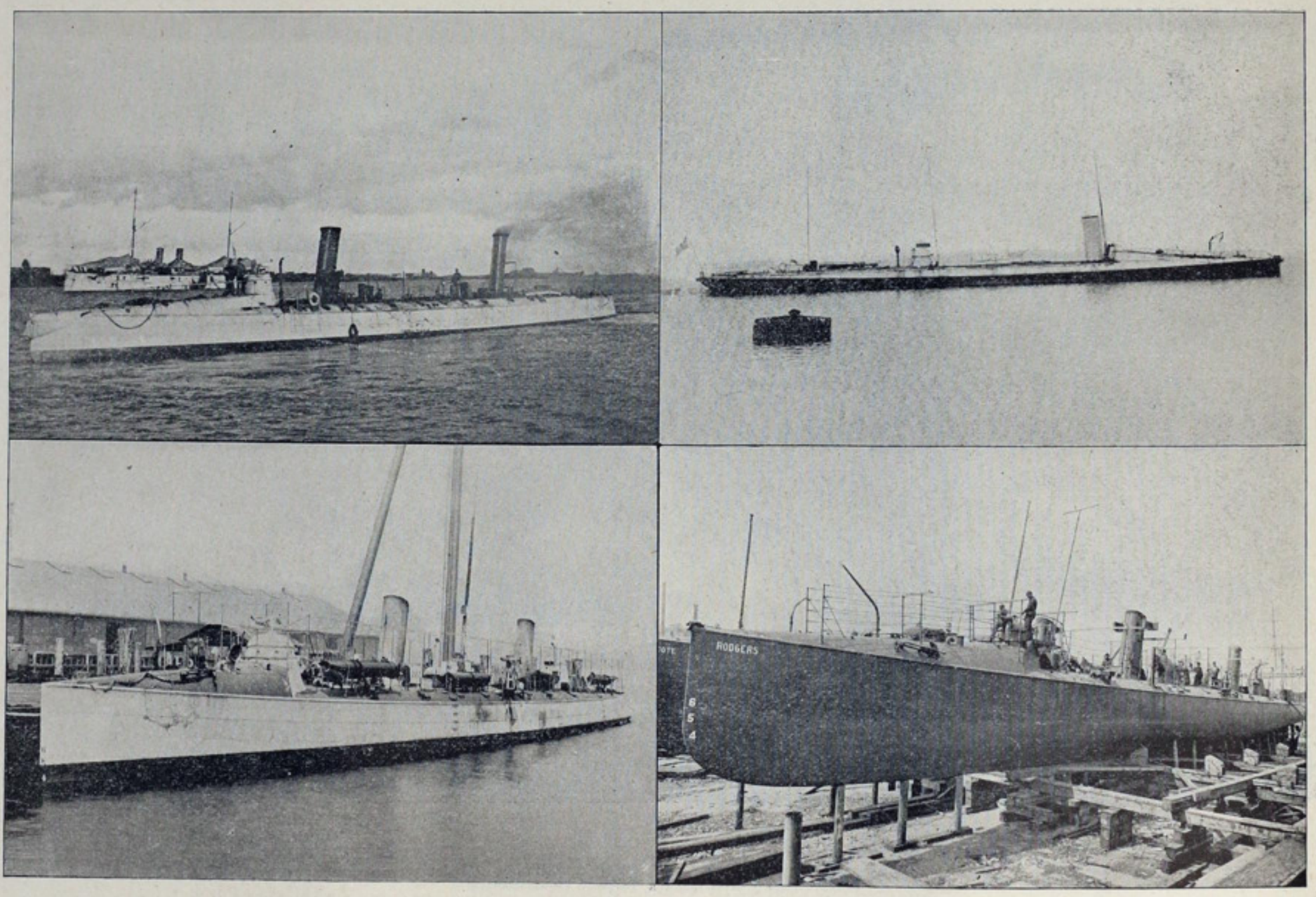
BY EUGENE TYLER CHAMBERLAIN,
UNITED STATES COMMISSIONER OF NAVIGATION.

There is doubtless a more general and a more active interest among Americans at the present time in the establishment of an American merchant marine for the foreign trade than there has been for at least a generation. The causes are not far to seek. Our very large expenditures in building war vessels have created ship building plants on the seaboard adapted to the construction of merchant steamships of the greatest size and highest class. Within a little over a year our navy has won signal victories which have impressed upon the rest of the world the belief that hereafter the United States must be consulted in matters relating to the oceans. We have recently acquired Hawaii and the Philippines in the Pacific and Porto Rico in the Atlantic, with a temporary protectorate over Cuba. Our insular possessions impose upon us obligations in the way of providing transportation facilities which we cannot neglect for their sakes, even if we could afford to be indifferent for our own. Manufactures have developed so rapidly that the place the home market filled in the political discussions of fifteen or twenty years ago is now filled by the foreign markets. Expansion, in the political sense, is a corollary of our industrial expansion, and for this reason we may rest assured that it has come to stay. With our thoughts turned to the over-sea trade, it was inevitable that at the same time they should be fixed upon the insignificant part American vessels fill in that trade. That insignificance was brought close home by the fact that the war department could not find as transports nor the navy department as colliers American vessels, but both were forced to buy steamships under the British flag to serve as these necessary instrumentalities during and since the war with Spain. All these reasons have had their influence in arousing an interest in the subject. That interest has been encouraged by the introduction of a bill by Senator Hanna of Ohio and Representative Payne of New York, reported by Senator Frye of Maine, which is the result of careful study and general consultation by the shipping and industrial interests of the United States, such as have not in many years been applied to measures relating to our maritime affairs.

A cursory examination of the progress of maritime nations and a glance at the methods they employ may be of some interest at a time when Americans desire a more creditable representation among the world's sea powers in time of peace. The usefulness of sail vessels and large barges for certain trades is not forgotten, but, as is familiar to all, the growth of ocean shipping is wholly in the line of steam. The world's sail tonnage has declined from 14,185,836 tons in 1873-4 to 8,693,769 tons in 1898-9. The steam tonnage of the ten principal maritime nations at the present time and twenty-five years ago, according to the records of the Bureau Veritas, with the percentage of each nation of the total and the percentage of growth for the quarter of a century is as follows:

STEAM TONNAGE OF MARITIME COUNTRIES NOW AND TWENTY-FIVE YEARS AGO.

	1873-4.		1898-9.		Increase 1873-4 to 1898-9 Per cent.
	Steam Tonnage.	Per Cent.	Steam Tonnage.	Per Cent.	
Great Britain	2,624,431	60.4	10,993,111	58.5	311
United States	483,040	11.2	810,800	4.2	68
France	316,765	7.4	952,682	5.1	200
Germany	204,894	4.8	1,625,521	8.3	693
Spain	138,675	3.3	520,847	2.7	275
Italy	85,045	1.9	420,880	2.2	395
Holland	72,753	1.7	363,200	1.9	399
Russia	67,522	1.6	358,415	1.8	430
Norway	41,602	.9	628,493	3.3	1,410
Japan	.....	.....	439,509	2.3	.....
All others	293,466	6.8	1,773,674	9.5	504
	4,328,193	100.0	18,887,132	100.0	336



THE ERICSSON.
THE FOOTE.
THE SOMERS.
THE RODGERS.

Representative Torpedo Boats of the United States Navy.

Norway's increase in steam tonnage, 1410 per cent, has been phenomenal, but it is even more remarkable that alone among maritime nations Norway retains as great a sail tonnage as twenty-five years ago. The country offers scant opportunity for agriculture, and manufactures are not conducted on a large scale. The Norwegian is compelled to turn to the sea for a livelihood. Since the abandonment of wood and the introduction of steel, Norway has ceased to be a ship building nation of importance. It does not need a large navy, and lacks that inducement for the establishment of domestic ship yards. Ships are a national necessity of the first importance, so Norway has long followed the "free ship" policy. She can operate vessels more economically than Great Britain and by buying vessels in Great Britain can thus successfully compete. So many Norwegians are sailors that the law of the nation, requiring two-thirds of her crews to be Norwegian subjects, is in effect no restraint on national navigation. Norwegian ships do not suffice to provide for her mariners. About 20 per cent of the seamen on American vessels are Norwegians and they constitute also a large percentage of the crews of British vessels. Norwegian natural conditions are thus so radically different from those which obtain in the United States that her progress offers little that is instructive in the solution of our problem.

In 1873 Japan's steam tonnage was so small as to be classed with the scattering, while this year that country has taken the seventh rank. The tonnage of Japanese steamships clearing from the United States for Asia in 1898 was greater than the corresponding American tonnage. Japan has found no inconsistency in adopting both the "free ship" and the subsidy policy. They are not conflicting propositions, but independent methods of dealing with two different subjects. Japan's present subsidy legislation contemplates a possible expenditure of about $5,000,000 annually, apportioned among fast steamships, general navigation bounties for slower vessels, bounties for the construction of steamships in Japan and fishing bounties. Japan has an abundance of seamen who work for low wages, and the Japanese laws require the crews of vessels to be Japanese subjects, officers in some cases being excepted by special permission of the government, until a sufficient number of Japanese have been trained to the service. Japan's naval rank renders it necessary for her to have ship yards of her own. She has already become one of the seven nations which can build steel steamships of 6,000 tons.

GERMANY'S GROWTH IN SHIPPING.

Next to Norway and Japan, Germany, which shows an increase of 693 per cent, has made the most rapid development as a maritime power. Her growth virtually dates from the adoption of the policy, urged by Prince Bismarck in 1881, and inaugurated in 1885. At that time German ship yards were not important. All the large German steamships were built in Great Britain, the lower cost of operation under the German flag permitting Germans to compete with the British, thus making the free ship policy available. In 1885 Germany voted an annual subsidy of 4,400,000 marks [mark=23.8 cents] to the North German Lloyd Steamship Co. for fifteen years for lines to Asia and Australia. This subsidy was increased to 5,590,000 marks last year. A subsidy of 900,000 marks for a line to Africa, begun in 1890, is to be increased to 1,200,000 marks next year. When this policy was begun Germany also established low freight rates on government railroads for ship building materials. To these legislative aids the Germans in official reports attribute their recent growth in ship building for the Atlantic as well as the Pacific trade. The difference in the cost of building steel steamships in Great Britain and Germany has been greatly reduced, German operating expenses are appreciably less than British, and Germany does not impose restrictions on the nationality of her crews. The Empire, too, has pursued for some years a vigorous colonial policy. Germany has developed her merchant marine before her navy, and is now using the ship building plants, promoted by government aid, in the construction of war vessels.

France in 1872 adopted the discriminating duty policy, which met with such effective retaliation and proved so disastrous that it was abandoned in 1873. In 1881 a policy of navigation and construction bounties was adopted, and continued with modifications in 1893. While many millions have been spent under this policy, the results have not been great by comparison with the progress of other nations. France is peculiar among nations in charging tariff duties on ship building materials, and as her construction bounties are in part designed to offset those duties, this form of aid to shipping is more apparent than real, being in fact a partial refund of amounts already paid by ship builders to the government. The navigation bounty system is peculiar in awarding larger bounties to sail vessels than to steamships, so that, under the natural decrease of sail vessels, the system calls for maximum expenditures with minimum results. Again, the French law provides that three-fourths of the crew of a French vessel shall be French citizens, a requirement which contributes materially to the reduction of the French mercantile marine. Other eccentric features of the French system are difficult to understand.

The Italian government has had in force since 1885 a system of general navigation and construction bounties in outline resembling the French, but without the latter's eccentricities. Italy's progress as a maritime and ship building power has been greater than that of France, though Italy is handicapped by meager native coal supplies. Both nations have adopted the "free ship" policy.

NO HEADWAY IN BLIND ADVOCACY OF ANY ONE SYSTEM.

Great Britain in 1839 began to subsidize steamships as soon as ocean steam navigation began to seem of probable importance. That nation, for political and commercial purposes, has steadily pursued that policy ever since, expending in some years upwards of $6,000,000 for the purpose. The "free ship" policy was adopted ten years later, in 1849, by Great Britain. It never has contributed to Great Britain's predominance on the sea, because until 1854 the British were handicapped by a law requiring the officers and three-fourths of the crew to be British. For twenty years before the civil war, the United States were building ships cheaper than they could be built in Great Britain. From 1854 to 1864, had the war not intervened, Great Britain would doubtless have purchased many vessels from the United States. The Rebellion drove 800,000 tons of American shipping to the refuge of the British flag. For a third of a century vessels have been built more cheaply in Great Britain than elsewhere in the world, so that the privilege of buying elsewhere is practically never used by a British shipowner, except occasionally in the colonies. By adopting this policy, however, Great Britain has encouraged other nations to follow the same course, from which British ship builders have undoubtedly derived great benefit.

This necessarily incomplete review of the navigation laws of other countries is made to illustrate how impossible it is to attribute to any one maritime policy a nation's success or failure. From natural conditions the "free ship" policy has been absolutely without effect in producing Great Britain's greatness, while it has been indispensable to Norway's welfare. General subsidies have pushed Japan rapidly forward on the ocean and have secured only meager results in proportion to expenditure in France. A stringent law as to nationality of crews is a matter of indifference to Norway, an injury to France and an impossibility for Great Britain and Germany.

No headway will be made in the United States by blind advocacy of any one system simply because it is in use by a nation which is successful on the ocean. We may entertain the hope, however, that by selecting from systems elsewhere in use those features which are best adapted to our own conditions and requirements we shall ten years hence take rank as a maritime commercial power. For in one respect the table above gives the United States greater prominence than we can claim. While the figures for other nations relate chiefly to their steam tonnage in the foreign trade, the figures for the United States include a large part of the splendid steam fleets of the Great Lakes and of the trade between our Atlantic ports, not subject to international competition. On July 1, 1899, our steam tonnage registered for foreign trade was only 360,030 gross tons.

The strength of the Hanna-Payne bill, so-called, lies in the fact that it is based on a selection from other systems, adapted to American conditions and requirements.

EXPERIMENTS WITH WIRELESS TELEGRAPHY.

REAR ADMIRAL BRADFORD, CHIEF OF THE BUREAU OF EQUIPMENT, WILL TAKE THE SUBJECT UP WITH SIGNOR MARCONI.

Rear Admiral R. B. Bradford, chief of the bureau of equipment, is not so very much impressed with experiments that have so far been made in wireless telegraphy. Those which he has witnessed have not been very successful from the standpoint of utility. Signor Marconi, the author of the Marconi system, is shortly to visit this country, and while he comes primarily on other business, Admiral Bradford will make it a point to see him.

"So far, from our observation," said Admiral Bradford, "wireless telegraphy has not been a success. But we cannot afford to let other nations get ahead of us. We will continue the experiments. I would prefer, however, to wait until I see Marconi before making a statement. Even granting that wireless telegraphy does all that is claimed for it, I cannot see that it is of much actual utility. One ship may signal to the shore with perfect intelligence, and indeed two may with the use of separate ciphers without creating any confusion, but if the opposing fleet should commence signaling would it not be to the confusion of all the rest? Why the opposing fleet might begin to telegraph the book of Genesis."

Admiral Bradford will, however, shortly undertake additional experiments in wireless telegraphy. The success which has attended the adoption of the system by the British navy has attracted the attention of the United States naval attache in London, Lieutenant Colwell, and he has submitted to the navy department interesting data bearing on the subject. Instruments will shortly be secured and experiments made between vessels and the shore. The operations of the system and its value to naval work are summed up as follows by a British expert:

"With wireless telegraphy signals can easily be made from ship to ship over a gap of thirty miles. No man need be exposed and no large staff is necessary. In some instances a range of fifty miles can be attained. The defects of the system for naval purposes are two—messages can only be sent slowly, and there may be disturbing interference with the signals from other transmitters in the neighborhood. The Juno, for instance, was taking a message from the Alexandria when suddenly a dispatch from Alum bay in the Isle of Wight, which was really meant for the Poole, began to come in. The latter had covered a gap of fifty miles.

"An enemy would be sure to set his transmitters so as to interfere with signals while his receivers would be adjusted to take in signals from any fleet he was watching. Thus all messages would have to be in cipher and in cipher constantly changed, for no cipher is undiscoverable. There can be no doubt, however, that the system will be rapidly improved. It has vast possibilities. It cannot, of course, remain the exclusive appanage of our navy but each advance in the art of long distance signaling tells heavily in favor of the superior naval power.

"Our program in war is to make the enemy's coast our frontier, so constantly our ships will be off the enemy's coast, while his, it is hoped, will be kept in the harbors. With this new system signals asking for help or describing the enemy's movements can easily be sent backward or forward between our fleets and their bases. If hostile torpedo craft try raids on our coast, or are seen near them, forces can quickly be called up to intercept them. In short the maneuvers have proved the great practical value of wireless telegraphy."

HONORING THE MEMORY OF GREAT MEN.

As one vessel after another of the big Rockefeller fleet of 6,000-ton ore carriers is turned out on the great lakes, the pleasant features of a suggestion from Mr. F. T. Gates of New York, that these ships be named for men of great accomplishments in the iron and steel industry or in the shipping world, become more apparent. No statue or tablet has as yet been erected by the vessel owners for Gen. Poe at the big canal lock in the St. Mary's river, but in a smaller way the memory of the army engineer who built that lock, and who was in fact the responsible head of most of the improvements undertaken by the government in the busy entrance to Lake Superior, is to be honored by the Bessemer Steamship Co. The Rockefeller steamer building at the Globe works, Cleveland, and which will be a modern lake carrier in all respects, is to be named Gen. Orlando M. Poe.

Another of the Bessemer company's vessels, one of the new steel barges, is to be named Robert W. E. Bunsen, in honor of the great German chemist, who died Aug. 16 of the present year in Heidelberg, and who was the inventor of the hot blast in furnace practice. But this was only one of his achievements. He was the greatest, with possibly a single exception, physicist of our times. "It may be noted on the part of our company," says Mr. L. M. Bowers, general manager, "that it adds greatly to the pleasure of doing this trifling honor to the memory of Bunsen when it was remembered that he was absolutely free from the least selfishness or egotism about his enormous discoveries and contributions to the advancement of science."

Bunsen was one of the shining lights of Heidelberg and one of the most modest of men. Honors bestowed upon him were the highest that could be obtained in a scientific career. He was the recipient of numbers of orders and decorations from the rulers of most of the countries of Europe, but he held them in small esteem.

The name of the steamer Globe, purchased not long ago by the Bessemer company, will be changed to James B. Eads, thus honoring the eminent civil engineer, who first acquired fame from the construction of the St. Louis bridge across the Mississippi river, and later through the construction of the piers at the mouth of the Mississippi river, which were the first to ever hold the Mississippi bar.

FOUR IMMENSE DRY DOCKS—LEAGUE ISLAND, MARE ISLAND, BOSTON AND PORTSMOUTH.

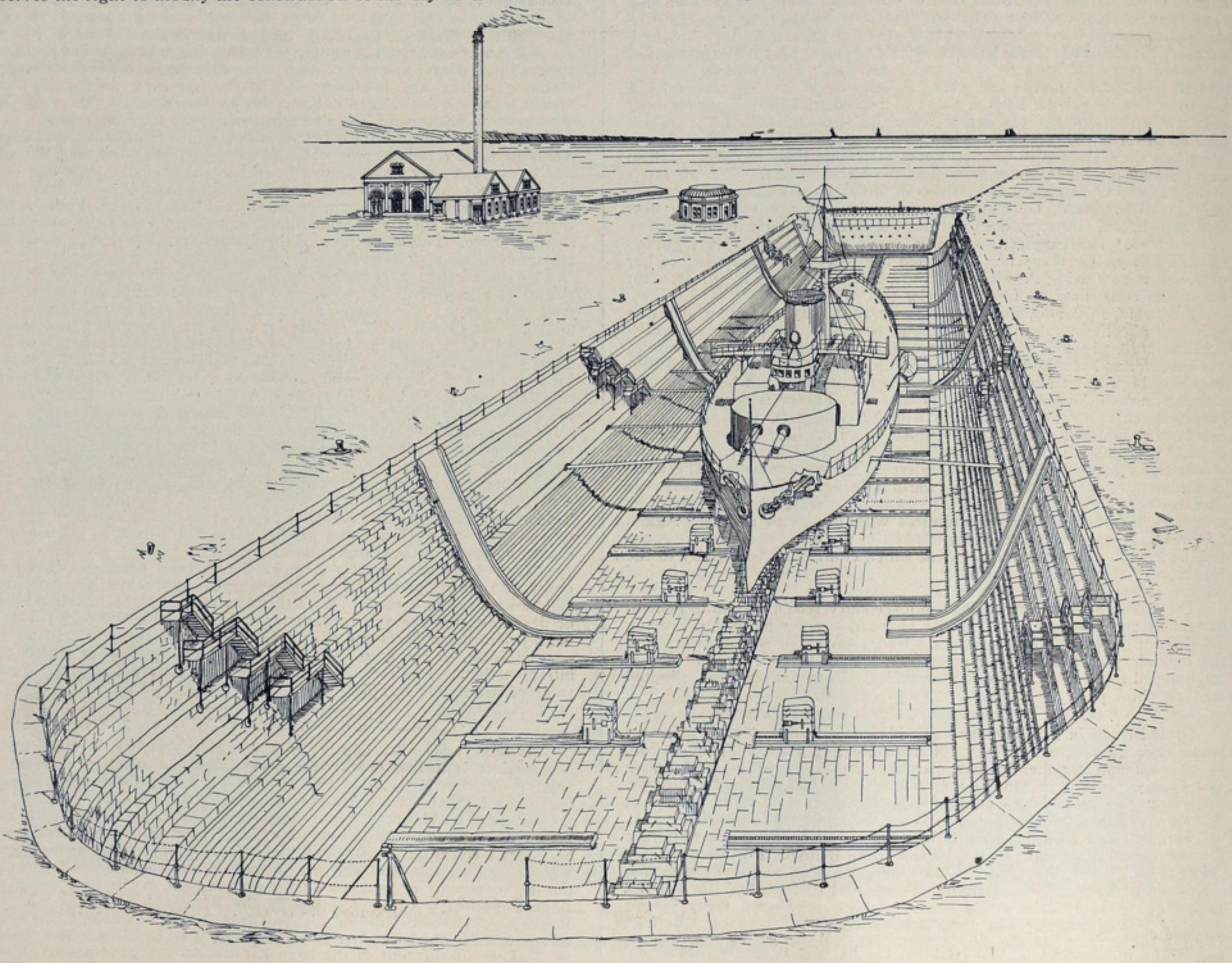
FROM PLANS AND SPECIFICATIONS FURNISHED BY REAR-ADMIRAL ENDICOTT,

BUREAU OF YARDS AND DOCKS.

Under the direction of Rear Admiral Mordecai T. Endicott, the bureau of yards and docks has now under way or plans prepared for the construction of four dry docks—League island dry dock, Mare island dry dock, Boston dry dock and Portsmouth dry dock. The first two named are to be of timber and the last two of concrete and masonry. Each pair considered in itself is almost identical; and therefore a description of one is a description of the other. Reference is first made in the following paragraphs to the League island dock.

There has been much criticism because the League island dock is to be built of timber. The bureau itself is in favor of a concrete and masonry dock, but the specifications prepared by congress provide for timber. The recent collapse of the New York dry dock, however, has given the country a warning, and considerable influence will be brought to bear upon congress to change the specifications. The government therefore reserves the right to modify the construction of the dry dock from one of timber to one of concrete and stone, should congress so authorize, and in the event of such a change being made the government will reimburse the contractor for the increased outlay in cost. Bids were recently opened for the construction of the League island dry dock but the bureau has deemed it expedient to reject them all.

The most popular description of a dry dock is to say that it is a coffin-shaped hole in the ground lined up with timber and fastened to piles. Piles are driven at accurate spaces at the bottom of the excavation and the evidence of their security lies in the fact that at the last blow of the hammer weighing 3,000 pounds and falling 25 feet the penetration shall be not more than half an inch. Transverse timbers are then put on top of the piles and longitudinal timbers on top of the transverse and then a flooring of 3-inch planks. All of the transverse timbers are to be in not more than three pieces, securely fastened together with scarfs and bolts. On top of the timbers rest the keel blocks, spaced 4 feet apart, and on the side are the bilge blocks spaced 16 feet. The heads of the foundation piles will be surrounded by a continuous bed of concrete at least 3 feet thick and extending up the sides in the body of the dock to the foot of the fifth altar.



THE NEW DRY DOCK AT THE PORTSMOUTH NAVY YARD, PORTSMOUTH, N. H.

The whole flooring will be surrounded by sheet piling and in the sides of the excavation inclined piles will be driven, and to these will be fastened the braces which carry the sides of the dock. These sides are composed of altars which have 11 inches rise and 9 inches tread, making a continuous stairway from the coping to the floor. The sides of the dock also have timber slides for sliding material down from the top to the bottom, and at each slide is an electric capstan for letting the material down into the dock. The caisson, or floating boat gate, of the dock will have eight watertight compartments arranged for flooding or emptying as desired, thereby making it a floating or sinking structure. It contains its own power for flooding or emptying its watertight compartments and operating the capstans and other mechanism. It will be built of open-hearth steel and will maintain an even keel under all conditions of flotation or submergence. Dimensions of the caisson are: Length, extreme, 106 feet 8 7-16 inches; breadth, molded, 22 feet; depth from bottom of keel to underside of upper deck at the side, 37 feet 9 inches. The hull of the caisson will be fitted and completed with centrifugal pump, locomotive boiler, vertical engine, feed tank, capstans, trimming tanks, gate valves and culverts, drains, hatches, air pipes, concrete and movable ballast, bitts, deck cleats, scuppers, aprons, air ports, stanchions and guard chains. The caisson will contain 509,000 pounds of structural steel and 596,700 pounds of concrete for stable flotation.

To pump out the dock a large centrifugal pumping plant will be established and will be driven by electric motor with power supplied from a general power station. The pumps will be situated in a circular well, about 53 feet in diameter with floor level of pump well about 36 feet below the level of the ground. The pumping plant will consist of three centrifugal pumps for pumping out the dock, with separate motors, all independent, and one centrifugal drainage pump and motor. These pumps admit water on both sides of the runners and give a discharge of 43,000 gallons a minute for each pump.

The only distinguishing difference between this dock and the one at Mare island is that the Mare island pumps will be driven by steam. General dimensions of the League island dock are:

	Feet.	Inches.
Length on coping from head to outer gate sill	750	
Length on floor from head to outer gate sill	717	9
Width on coping in body	144	6
Width on floor in body	80	
Width on coping at abutment, least	104	3
Width at entrance on mean high water level	101	
Depth from coping to mean high water	6	6
Depth from coping to floor in body	40	3
Draught over sill at mean high water	30	

PORTSMOUTH, N. H., AND BOSTON DRY DOCKS.

No piling whatever is contemplated for the Portsmouth dry dock. The bottom and sides will rest on solid rock, which has to be blasted out. This dock will doubtless be one of the most stable things in Christendom. The stone masonry of the body of the dock will consist of granite. The bottom and sides will be composed of granite and the interior lined with granite ashlar. The stone masonry of the walls and entrance will be ashlar in continuous courses and is to be rough pointed on the face and fine pointed on altar treads and on floor. The altar system will be different from that of the League island dock, having deep altars of 4 feet with the lower portion made up of a number of low altars.

The keel blocks, bilge blocks and bilge block slides are to be of white oak and all fittings for them will be of composition. They are to be spaced the same as in the timber docks. The entrance to the dock will be closed with a caisson or floating gate. The change of shape is slight, the corners being rounded off, while in the timber dock they are not.

The pumping plant, which is almost identical with that of the League island dock, will be driven by an electric motor with power supplied from a central power station. To facilitate the hauling in of the ship and the handling of her while she is being docked, there are placed at the entrance of the dock and at the head three electric winches and along the side at each timber slide is placed an electric capstan, and bollards are spaced at intervals about the dock.

The Boston dock differs from the Portsmouth dock only in that it is built upon compacted clay with heavy concrete foundation. Dimensions of the Portsmouth dock are:

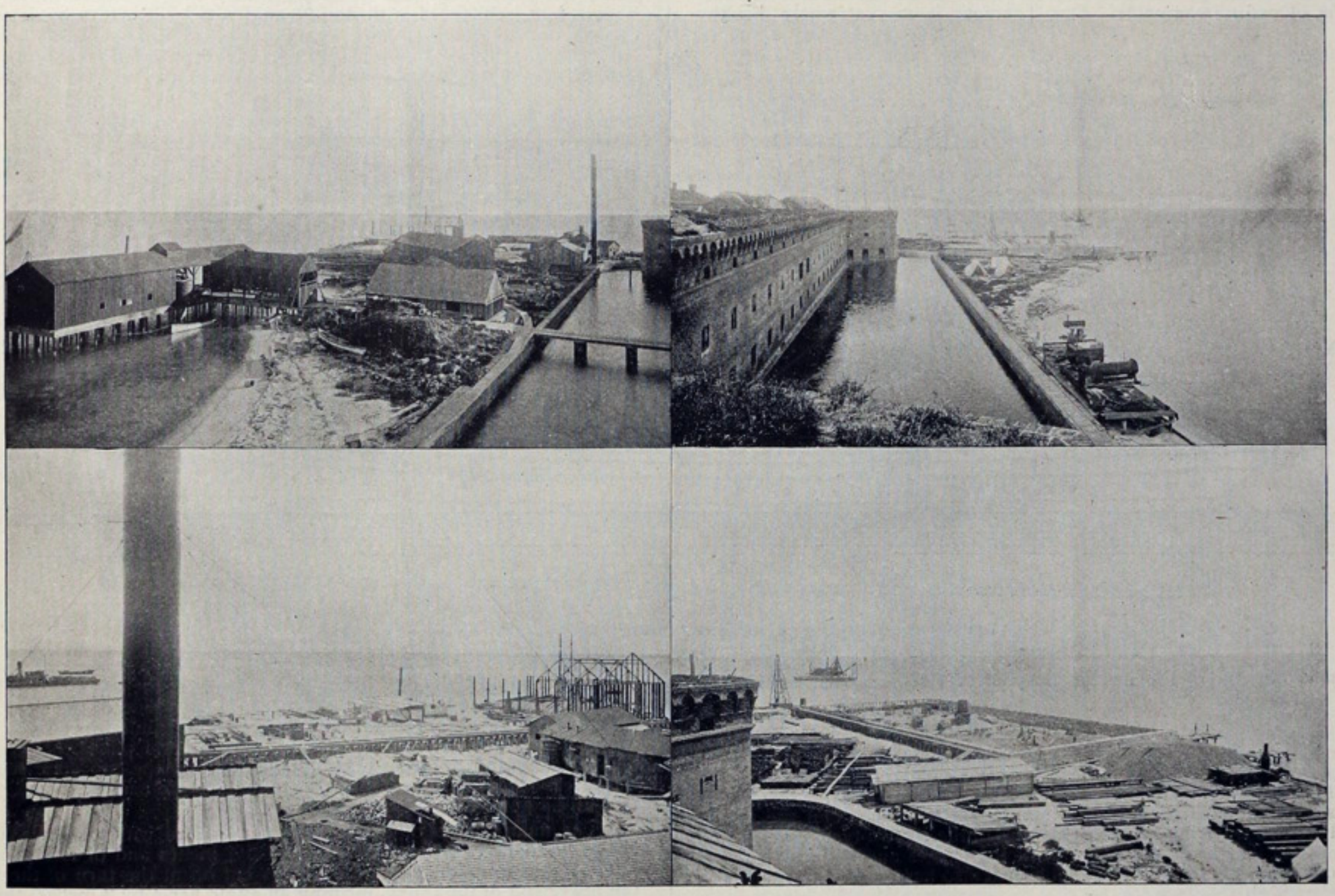
	Feet.	Inches.
Length on coping from head to outer gate sill	750	
Length on floor from head to outer gate sill	725	
Width on coping in body	130	
Width on floor in body	80	
Width on coping at abutment, least	101	9
Width at entrance on mean high water level	100	
Depth from coping to mean high water level	5	3
Greatest depth from coping to floor in body	39	3
Draught over sill at mean high water	30	

The Boston and Mare island docks are now under way and bids are being solicited for the Portsmouth and League island docks. These docks when completed will accommodate the largest thing afloat, including the auxiliary cruisers and the monster Oceanic.

The following is a table showing the United States naval docks already in existence:

UNITED STATES NAVAL DRY DOCKS.

Character.	Station.	Material of Construction.	Length on Floor.		Width of Entrance at Coping.		Depth Over Sill at Mean High Water.	
			Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
Balance	Portsmouth, N. H.	Wood	350	0	90	0	25	0
Graving	Boston, Mass.	Granite	367	5½	60	0	24	10
"	New York, N. Y.	Granite	338	3	66	0	25	3
"	New York, N. Y.	Wood	459	10	85	0	25	6
"	New York, N. Y.	Wood	626	8	105	2⅞	29	0
"	League Is., Pa.	Wood	459	10	85	0	25	6
"	Norfolk, Va.	Granite	302	9	60	0	25	0
"	Norfolk, Va.	Wood	459	10	85	0	25	6
"	Port Royal, S. C.	Wood	459	0	97	0	26	0
"	Mare Is., Cal.	Granite	459	0	80	6⅞	27	6
"	Puget Sound, Wash.	Wood Body—Masonry Ent.	618	6	92	7⅞	30	0



COALING STATION AND FORTIFICATIONS AT DRY TORTUGAS, FLORIDA.

UNITED STATES NAVAL COALING STATIONS.

DESCRIPTION OF THE PLANTS AT KEY WEST, DRY TORTUGAS AND NEW LONDON —APPROPRIATIONS FOR STATIONS AT FOUR OTHER POINTS.

The enlargement of the navy has caused the government to turn its attention most seriously to the subject of coaling stations. Three of them are now under way and four more are in contemplation. Coal is the life of the modern ship and it must be had at all hazards.

The plant at Key West consists of two steel coal sheds known as shed A and shed B. Each shed is provided with two of the Brown Hoisting & Conveying Machine Co.'s traveling bridge conveyors. Shed A is rated at 5,000 tons and shed B at 10,000 tons capacity. The superstructure is composed entirely of steel, which rests on a concrete wall, which in turn rests on piling, and the whole is riprapped. The sheds are so arranged that the coal is put in or taken out through the roof, which is fitted with movable hatches. Light is admitted to the shed by means of heavy corrugated glass skylights. Between the wharf and pier is left a space large enough to accommodate barges. In case a man of war wants to coal directly from a barge instead of from the store, the hoisting apparatus is so arranged as to swing entirely over the wharf. In storing coal the barge runs between the wharf and pier, leaving the front of the pier free for any man of war that may want to come alongside. The pier at Key West is 306 feet long by 50 feet wide and is built entirely of steel with the exception of the fenders and the floor planks. It has a timber approach 464 feet long by 18 feet wide. The pier is of 6-inch steel piles, which are spaced 16 feet apart and driven into the rock until the proper resistance is obtained

and then firmly braced together at the pile caps and also at a distance of 18 feet below the low water line. The bracing is so designed that it can be put into position without the aid of divers.

DRY TORTUGAS PLANT.

The plant at Tortugas consists of two sheds and two piers of the same construction, with the exception that the sheds are built upon the beach instead of over the water as is the case at Key West. Each shed at Tortugas has a capacity of 10,000 tons. In conjunction with the coaling plant there is also a large condensing plant to supply ships with fresh water. The condensing plant consists of engines, distilling apparatus, condensers, a storage reservoir and a standpipe with a proper distributing system of pipes, which run to the wharf, where connections can be made with the ship. There is a channel being dredged around Tortugas which will admit of the heaviest man of war reaching the piers. It will be completely buoyed and the buoys lighted by electricity. Day or night vessels can take on coal or water.

Dry Tortugas is one of the most beautiful spots on the face of the globe, but it is also one of the most unpopular posts in the navy department. It is seventy-five miles from the rest of the group of islands and it is so small that one may walk around it in thirty-five minutes. At one time it was considered a fine strategetical point and about $14,000,000 was spent in establishing Fort Jefferson upon it. Several of the guns are lying there now unmounted and the old fort is a mass of cocoanut trees and tropical plants. The island is surrounded by white coral rock, which rises out of the clear green water and makes one of the most beautiful combinations of color imaginable. Dry Tortugas is an extremely healthy place and a station of the marine hospital service has been established there.

NEW LONDON STATION.

The New London coaling plant consists of a steel coal shed of 20,000 tons capacity. It is situated on the land with a pier in front of it approximately 132 feet away. There is a water space between the pier and shed to be used by the coal barges. Running upon the wharf and the top of the shed are two traveling bridge conveyors of the Brown type, upon which travel buckets that hoist the coal out of the barges and through hatches in the roof deposit it in the shed. This shed also has running through it a railroad track on trestle work, so that it can receive its coal supply from railway trains, the cars running into the shed and dumping there. The pier in front of the shed is a steel pier, built somewhat like the one at Tortugas, except that the piles are hollow Phoenix columns. The conveyors are so arranged that the bucket can be dropped into a hopper, which has a weighing and bagging arrangement so that a tally can be kept on the weight of coal that each ship receives. In fact all of these conveying devices have automatic weighing apparatus. One may tell the weight of coal put in and taken out of a ship at any time. By the introduction of modern machinery at coaling stations the cost of putting fuel aboard vessel has been reduced to a few cents per ton.

Coaling stations, well equipped, are indeed very much needed by the navy. Appropriations have been secured for coaling stations at Portsmouth, N. H., Boston, New York and Port Royal, S. C.

TO SECURE A SHARE OF EASTERN BUSINESS.

It is understood that the Fuller ventilating company of Detroit contemplates moving its factory to some eastern point. This company's works is being operated night and day, their business being more than double that of last year. They have recently taken contracts for the equipment of two United States troop ships and they are also supplying a complete outfit of ventilating apparatus to the Russian battleship building at the works of the Wm. Cramp & Sons Co., Philadelphia. The development of eastern business in this line is what prompts the plans for removal.

A valuable and instructive article on the work of the coast and geodetic survey—a most interesting department of governmental work—which was crowded out of the naval edition of the Review will appear in an early issue. It is illustrated from new photos.

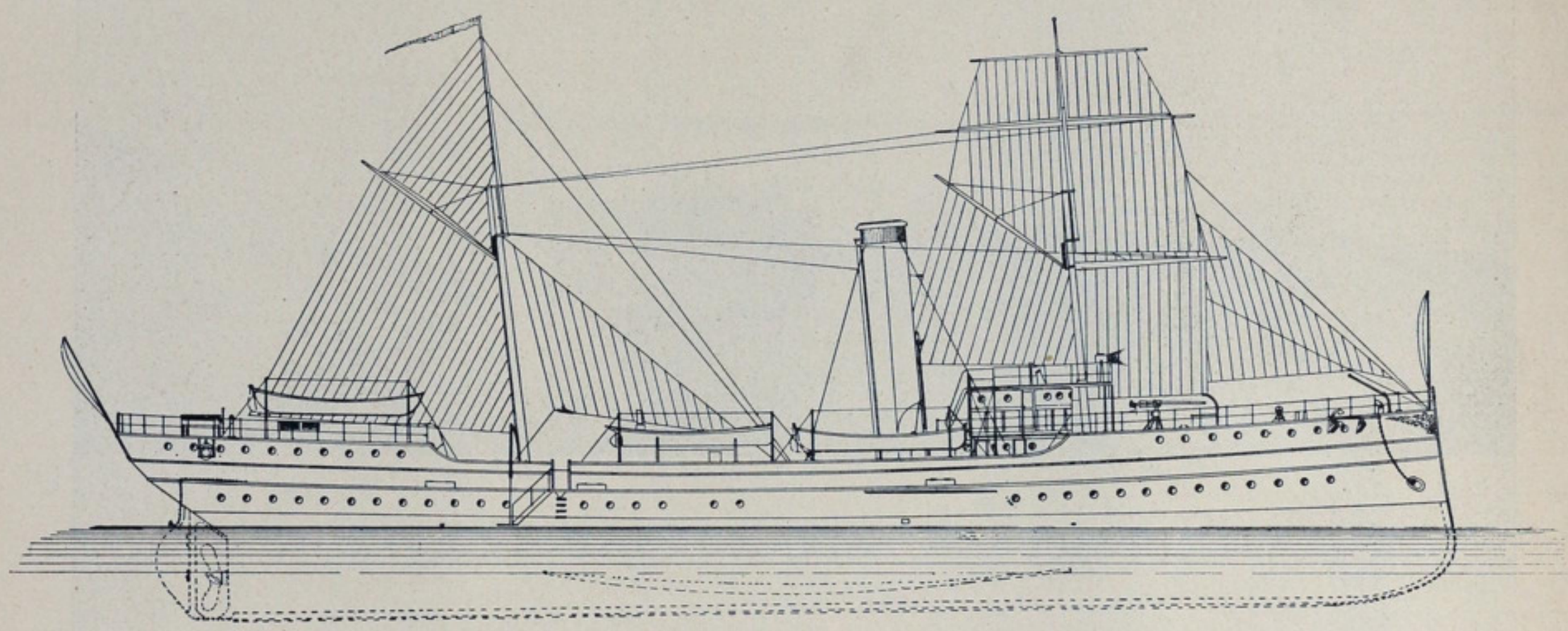
NEW REVENUE CUTTERS.

DESCRIPTION AND PLANS OF TWO VESSELS OF THE FIRST CLASS, ONE FOR COAST SERVICE AND THE OTHER FOR THE GREAT LAKES.

Two very handsome new vessels will ere long be added to the revenue cutter service of the United States, which rendered such efficient assistance during the Spanish-American war. Plans for these vessels are now nearing completion in the office of the superintendent of construction of the service, and the outboard drawings, the first as yet given out, are presented herewith. For one of these new cutters the last congress made an appropriation of $165,000 while for the other the approapriation was $225,000.

The first of the two vessels, officially known as No. 7, will be built of steel and is designed for service on the great lakes. Her dimensions are: Length over all, 178 feet; length between perpendiculars, 162 feet; breadth of beam, molded, 30 feet; depth at side, amidship, 15 feet. The vessel is to be built of steel throughout, and will be fitted with eight watertight athwartship steel bulkheads, made of 7½, 8½ and 10 pound per square foot plates, stiffened with vertical stiffeners, 3 by 2 inches, of 4.1 pounds. These bulkheads are to be tested and made perfectly watertight by calking, and no cement or any other foreign matter to be used.

The keel is to be of the flat type, composed of two thicknesses of plates, 14 pounds per square foot, well riveted together. Above these inner and outer flat keels will be built a vertical keel of 15 pounds per square foot, reinforced with double angles, 3 by 3 inches by 7 pounds at lower edge and 2¾ by 2¾ inches by 6 pounds at the top edge. There are to be six intercostal longitudinals, three on each side of the vertical keel, standing square with the outside plating; the four inner ones to be of 12½-pound plates and the two outer ones of 10-pound plates, flanged at the bottom edge and riveted to the outside plating, the top edge secured to the reverse bars, etc., by continuous double angle bars of 3 by 2½ inches and of 6.6 pounds per square foot.



OUTBOARD PLAN OF NEW REVENUE CUTTER FOR PACIFIC COAST SERVICE.

The main frames of the vessel stand square with the base line, and are to be made of Z-bars, 5 by 3¼ by 3¼ inches and of 11.6 pounds per foot. The upper flange of the Z-bar is cut off at the turn of the bilge to the lower end of the frame, forming an angle bar 4 by 3 inches; this lower end cuts off against the lower continuous angles of the vertical keel. At the extremities of the vessel the frames are formed of 3 by 3 inches by 7-pound angle bars and 7.5-pound bracket plates. Between the main frames and reverse frames, forward and aft, floor plates of 10 pounds per square foot are worked; within the engine and boiler spaces 15 and 12-pound plates are worked; the floors forming boiler saddles 17.5 pounds per square foot.

The outside plating is formed of 14 pounds per square foot below the main deck; above the main deck 10 pounds per square foot will be used. The main deck beams are formed of angle bulb 6 by 3 inches of 12.3 pounds, split and turned down at the ends to make good connection with the main frames. The berth deck beams are formed of angle bars 3 by 2½ inches by 6.6 pounds per square foot, secured to frames by 8.5-pound bracket plates. The forecastle deck beams are of angle bars 3½ by 2½ inches by 6.6 pounds per square foot. The frames and beams are spaced throughout 24 inches. The deck planks will be of Georgia yellow pine throughout, 3 by 3 inches, in lengths of 25 to 30 feet, and will be calked according to the standard method of calking.

The pilot house and chart room are located on the forecastle deck just aft of the foremast. These houses are to be built of steel complete except the doors in the pilot house. The steering of the vessel is done from here by a steam steerer, which is so arranged that it can be operated by hand or steam from the pilot house, and steam from the top of bridge. A screw hand gear is also fitted aft over the top of rudder head.

The berthing space for the crew is on the berth deck forward and also under the forecastle deck. Mess lockets, water closets, bath rooms, etc., are fitted for the men's convenience. The petty officers, boatswain, carpenter and oiler have their staterooms and mess rooms directly aft of the crew's space on the berth deck. The wardroom officers are located on the berth deck aft of the machinery space. The ward dining room runs the whole length of wardroom between the wardroom officers' staterooms.

Buffet, writing desk, tables, chairs, etc., are fitted for the convenience of the officers. The captain's quarters will be located directly aft of the wardroom, under the main deck, where he will have his pantry, office, cabin stateroom, bath room, etc.; all fitted in the best possible manner.

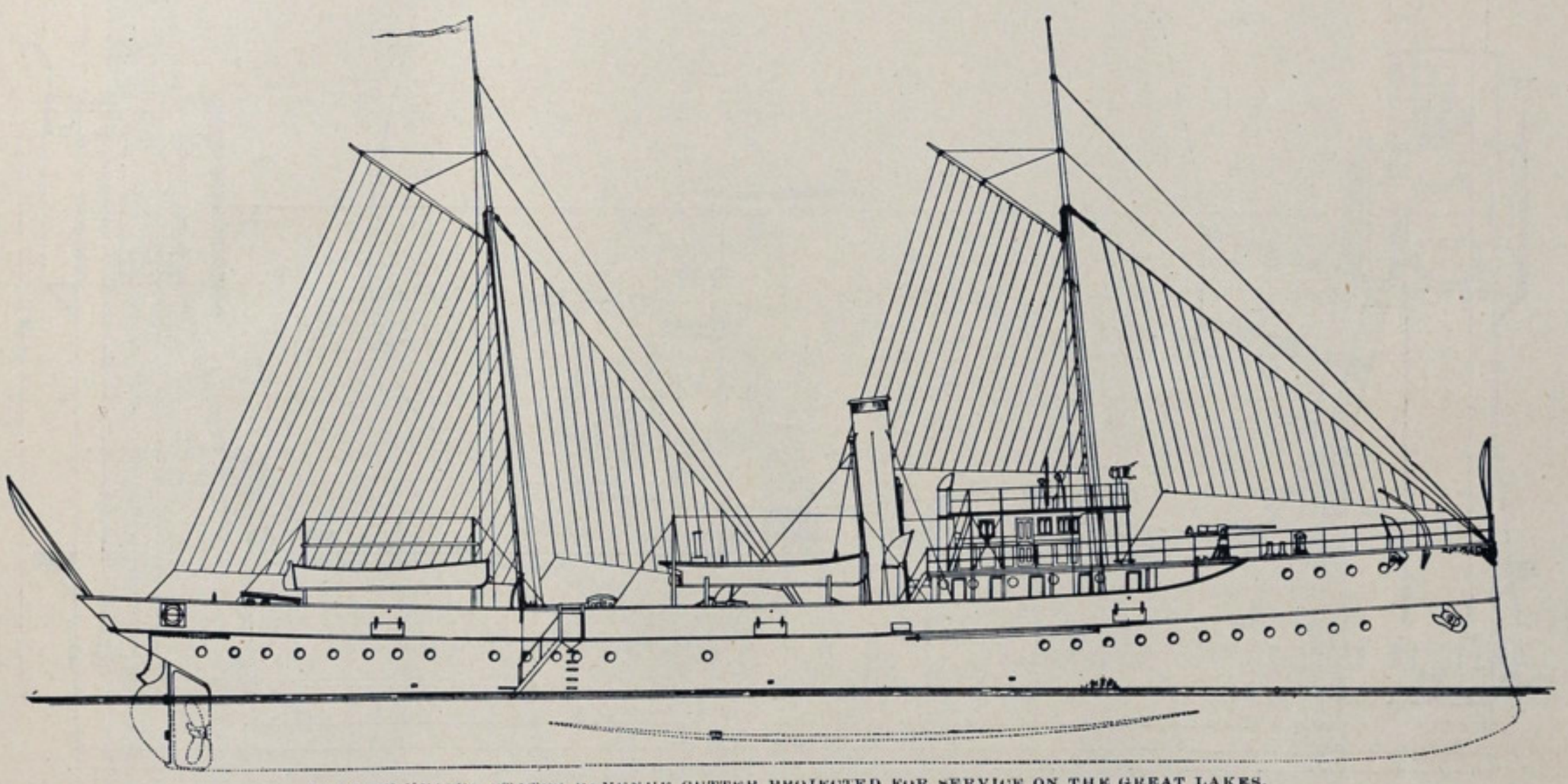
The main engine will be of the vertical, inverted cylinder, direct acting, triple expansion, surface condensing type, with cylinders of 17, 27 and 43 inches diameter and 24 inches stroke. Steam will be furnished by two single-ended boilers of the horizontal return fire tube type, constructed for a working pressure of 160 pounds per square inch. Each boiler will have three corrugated furnaces of 39 inches internal diameter. The total heating surface will be about 3,000 square feet, grate surface 108 square feet. The boilers will be 11.8 feet outside diameter and 10 feet long over all. Independent feed pumps will be fitted in fire and engine rooms. The forced draft will be of the closed fire room system; air will be supplied by one blower, which will discharge into the fire room. There will be one hydro-pneumatic ash ejector furnished complete. Steam reversing gear, hand pump, circulating pump of the centrifugal type, bilge ejector, air pump, distiller, etc., are to be furnished complete.

The other revenue cutter, known as No. 8, will be a sheathed ship of the poop and forecastle deck type, the principal dimensions of which are as follows: Length over all, 205 feet 6 inches; length between perpendiculars, 188 feet 6 inches; beam, molded, 32 feet; beam, extreme, 32 feet 10 inches, and depth at side amidship, 17 feet. This vessel is to be built of steel throughout and will be fitted with eleven transverse watertight bulkheads. The frame will be of Z-bars, spaced 24 inches between center, and the ship will be strengthened longitudinally by a vertical plate keel and six intercostal longitudinals running forward and aft. The outside plating will be formed of 14 pound per square foot double at the sheer strake for about 100 feet amidships.

The captain's quarters are located under the poop deck and are fitted with captain's stateroom and bath attached on starboard side and spare stateroom and bath attached on port side. Forward of the stateroom is the main cabin, with transom sofas that can be converted into beds to accommodate two guests. The main cabin is fitted with chiffonier, book cases, buffet, tables, etc., complete; forward of the cabin is the captain's pantry and office, and under the break of the poop are offices for the executive officer and navigator. Below these quarters on the main deck are fitted accommodations for the wardroom officers, four large staterooms for the deck officers on the starboard side and three staterooms on the port side for the engineer officers and surgeons. Directly forward of these rooms is fitted a large and well ventilated dining room with seating capacity for fifteen persons. On each side of the wardroom country the wardroom pantry, armory and dispensary are fitted. The chief petty officers are berthed aft on the berth deck forward, and have excellent accommodations—dining room, baths, etc., complete. Hammock hooks for berthing sixty men are fitted to the forecastle and main deck beams. Under the forecastle head are store room, refrigerators, bath room and water closets, all fitted with the modern appliances.

The vessel will be steered with a steam steerer, to be worked by steam or hand from the pilot house, and by an improved hand steerer aft over the rudder head. The vessel will be sheathed on the outside of her plating with pine about 5 inches thick amidship and secured to the outside plating with manganese bolts securely fastened in place. The decks will be of Georgia yellow pine throughout.

This cutter will be propelled by one vertical inverted cylinder, direct acting, triple expansion engine, having cylinders of 25, 37½ and 56¼ inches diameter with a common stroke of piston of 30 inches. The collective indicative horse power will be about 2,400, and the vessel is expected to make 18 knots when running under full steam. There will be four single-ended, steel boilers of the Scotch type, all constructed for a working pressure of 160 pounds per square inch. The boilers will be placed in one compartment and will have a total heating surface of 5,250 square feet. The boilers will be 11 feet 8 inches outside diameter, and 10 feet long over all. Main and auxiliary feed pumps will be fitted.



PLAN OF UNITED STATES REVENUE CUTTER PROJECTED FOR SERVICE ON THE GREAT LAKES.

ALGIERS FLOATING DRY DOCK.

A DESCRIPTION OF THE FLOATING STRUCTURE THAT IS BEING BUILT AT THE WORKS OF THE MARYLAND STEEL CO., SPARROW'S POINT, MD.

The floating dock which is now under construction by the Maryland Steel Co. at Sparrow's Point, Md., and which is to be stationed at Algiers, La., is the largest floating dry dock in the world and is designed to dock the greatest battleship or armored cruiser afloat. It will lift a ship of 15,000 tons. At present the government has no ship in its service of that tonnage but it is quite likely that within a very few years it will have. The dry dock is therefore being built for the future.

The dock itself consists of five pontoons, comprising three pontoons which form the main lifting portion of the dock and two side walls which serve to give the dock stability. The pontoons themselves are of different size and form. The center pontoon, which is 240 feet long, is rectangular in shape, but the terminal ones have each only 80 feet 6 inches of their length rectangular, the remainder being finished off in the form of a blunt-nosed point or bow. For a length of 55 feet these pontoons are also bouyant, but the remaining or outside 30 feet, forming the point proper, is formed by a series of plates and lattice girders of strong construction that support the ends of a ship without at the same time giving any buoyancy to the ends of the dock when short vessels are placed thereon. These end platforms have, however, the deck plating watertight and are surrounded by the watertight bulwark, which runs around the whole of the end of these pontoons.

The pontoons of the dock are divided into thirty-two pumping divisions, of which twenty-four are absolutely watertight and distinct. The sidewalls have each four watertight divisions. All these forty divisions are provided with a separate pipe, each governed by a separate valve. All the pipes in the starboard half of the dock are led directly into the main drain in the starboard wall and all in the port half to a similar drain in the port wall. These drains are continuous over the whole length of the walls and the four pumps in each wall are seated directly in them so that any one pump can empty all the compartments of its half of the dock. In the event of a break-down of a half the other half could empty the whole dock.

A separate engine is provided for each pair of pumps and a separate boiler for each engine. The steam pipes are, however, so arranged that either engine can take its steam from either boiler. This duplication prevents a complete break-down. Steam is the only motive power used in the dock. Although the dock is divided into forty sections, each with its own regulating valve, the work of the whole dock is done from two central positions on the top of the towers. Each valve house is in direct communication by speaking tube with its engine rooms, so that the man in charge can manipulate every valve, both water and steam, for the maneuver of the dock without quitting his post.

The dock floats at a draught of 4 feet. The valves are opened and the dock sinks bodily. It sinks to such a depth from floor line to top that it will take a ship of 30 feet draught, leaving it only 4 feet out of water. The dock is built of steel plates and angles. Great care must be exercised to see that the ship centers on the keel blocks. Then the pumps are set to work and the water is pumped out of the watertight compartments. The operator must see to it that the dock remains perfectly level. This can be regulated by shutting off a pump and leaving water in as a counterbalance. The watertight compartments have great value in controlling balance. Having seen that the keel of the ship and the keel blocks are even, as the boat comes out of water shores are put in place to give additional steadiness to the sides of the ship. When the deck of the pontoon is 2 feet out of water the surface of the ship is actually 6 feet out of water when one gets ready to work on it.

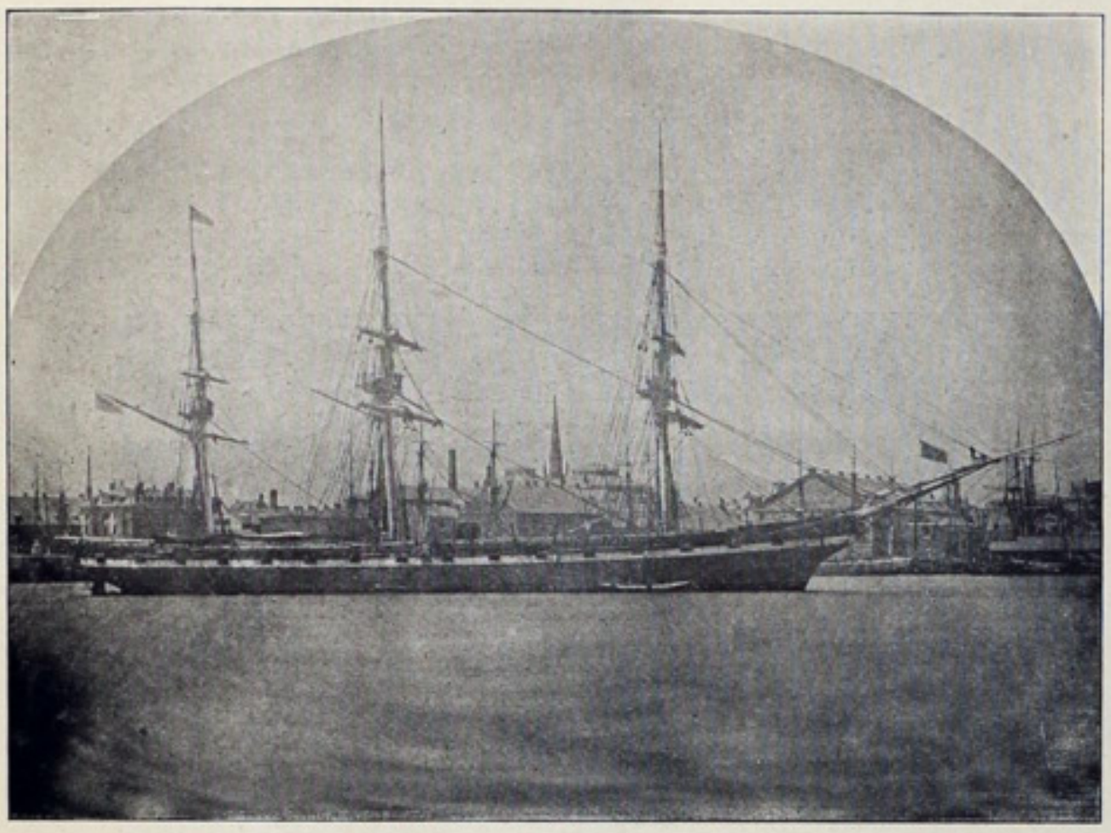
One of the great features of the dock is its self-docking qualities. Provision had to be made for this, for like any other vessel it could get out

CRUISER BROOKLYN PASSING UNDER BROOKLYN BRIDGE.

FARRAGUT'S OLD FLAG SHIP, THE HARTFORD.

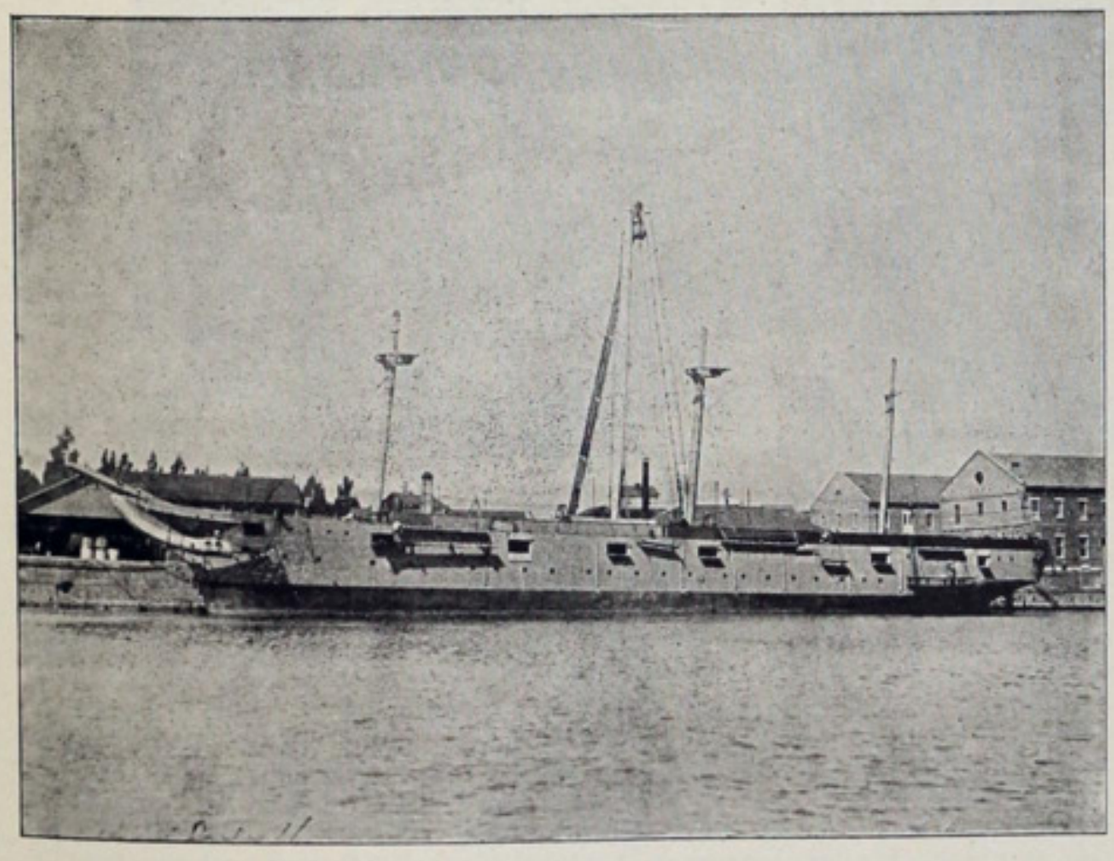
TO BE PRESERVED AS A TRAINING SHIP.

Of all the large fleet of ships that served in our navy during the civil war, probably only two are generally remembered by people who have no direct connection with naval affairs, and have thus earned enduring fame. These are the Hartford and Kearsarge. The latter has had her name continued in a modern first-class battleship, which was launched last spring at Newport News, and the former will soon be placed again in commission, largely rebuilt, as far as her hull is concerned, but still preserving her original appearance, with new machinery and a new battery of modern 5-inch, rapid-fire guns, to replace the old 9-inch smooth-bores of her earlier days. In her day, for she was built just forty years ago, she was considered one of the finest steam sloops of war which had ever been constructed. She was designed by Naval Constructor E. H. Delano, and



THE HARTFORD—JUST BACK FROM SOUTH PACIFIC STATION.

built under his supervision at the Boston navy yard. She was launched Nov. 23, 1858. While she was fully up to date at that time, the descriptions given in contemporary journals seem very queer and old-fashioned to us now. She is 225 feet long on the water line, 264 feet long over all, 44 feet beam, 21 feet deep. 16 feet draught of water, and 2,550 tons displacement. She had two single-cylinder horizontal trunk engines, and two Martin rectangular boilers, such as were almost universally used in those days. She was full ship rigged with a spread of 19,000 square feet of plain sail, and was pierced by thirty-four ports, including bridle and stern ports.



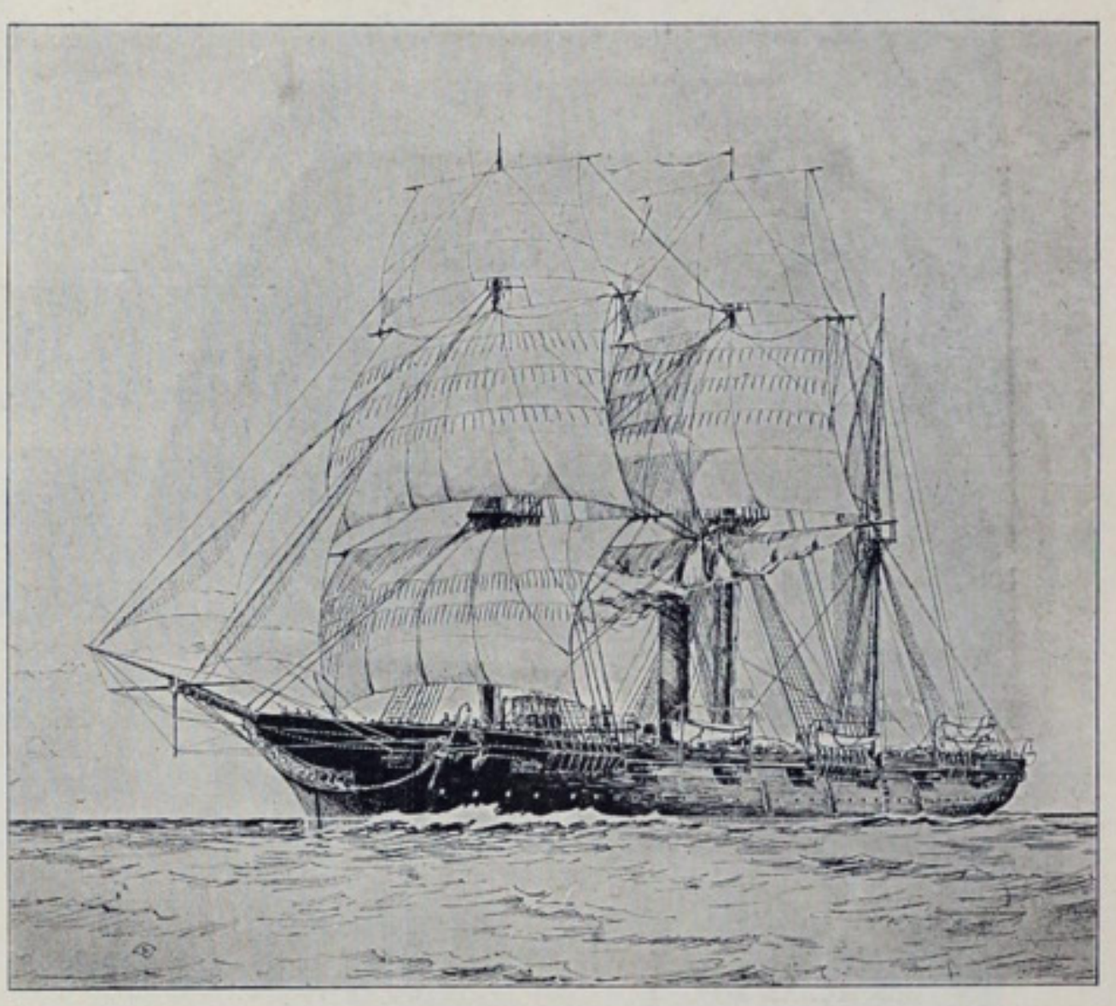
THE HARTFORD AS SHE APPEARED JULY 1, 1899.

Her battery consisted of fourteen 9-inch smooth-bore guns, though she could mount thirty of the same size in emergency. Her speed under steam was about 8 knots, which was great for those days.

On Feb. 2, 1862, the Hartford sailed from Hampton Roads as the flag ship of Commodore David B. Farragut, bound, with a large and powerful fleet, for operations in the Gulf of Mexico. Farragut was enthusiastic about the qualities of his flag ship, and she was destined to remain his home during the remainder of the war, and is thus closely associated with his whole glorious record. She carried at this time twenty-two 9-inch Dahlgren and two twenty-pound Parrott guns, and her fore and main masts were fitted with the rudiments of what we now call military tops. The first operations of the fleet were against the defenses of New Orleans, and after a bombardment of six days, commencing April 18, came one of the most brilliant and memorable actions of the war, the fight with forts Jackson and St. Philip and the supporting Confederate fleet, ending in the destruction of the latter, the successful passing of the forts and the surrender of New Orleans April 25.

On the night of March 14, 1863 occurred the memorable action with the defenses of Port Hudson, and the only ships that succeeded in passing the forts were the Hartford and the Albatross, the latter a small gunboat. In this action the Hartford was much cut up about her hull and rigging, but her machinery was uninjured and only one man was killed and two wounded. After this, the ship sailed to New York for repairs, and upon examination it was discovered that she had been struck 240 times by shot and shell during nineteen months of service.

Her most glorious action, the battle of Mobile bay, was fought on August 5, 1864. It was here that Farragut was lashed in the Hartford rigging, the most exposed position possible, to direct operations, and it was here that when the Brooklyn signaled "torpedoes ahead" he gave the memorable order, "Damn the torpedoes, go ahead." Here, also occurred her great fight with the Confederate ram Tennessee, a vessel that was believed to be almost invulnerable. This action practically closed her great record, but as the record stands it is equalled by few ships in the world. Should the nation be niggardly about preserving her? After the close of the civil war, she was refitted for peace cruising, but our wooden ships were already becoming obsolete. For many years our navy drifted farther and farther toward oblivion, and when, shortly after we had commenced its reconstruction in 1884, congress passed a law forbidding the repair of any wooden ship when the estimated cost of repairs exceeded 20 per cent of the estimated cost of a new ship of similar type, the old Hartford, with all her glorious memories, was ordered to be sold as old junk, and broken up. Chief Constructor Hichborn, at that time assistant to



THE HARTFORD AS A TRAINING SHIP.

Chief Constructor Wilson, immediately started an agitation of the question of preserving the vessel, and was finally successful in inducing congress to pass a special appropriation for her reconstruction.

The work of reconstruction was begun in December, 1894, at the Mare island navy yard, and was well along toward completion when it was interrupted by the necessity of using all the facilities for more important work in connection with the recent war with Spain. Now, however, work has been resumed and she will be commissioned next summer. She has new engines and boilers capable of giving her a speed of 12 knots, and will be armed by a modern battery of thirteen 5-inch rapid-fire guns. Her rig has been changed from a ship to a bark, with no royal yards.

Not only have we preserved this historic ship, but it seems likely that she will be of great value, especially in connection with our newly acquired territory, her copper bottom enabling her to make long cruises among the South Pacific islands, without the need of docking. Some day, when the ship can no longer be made useful, it is to be hoped that her name may be preserved in a new and powerful ship, worthy of her traditions.

The Hartford went out of commission upon her return from the South Pacific station Jan. 14, 1887, and has been out of commission ever since. As soon as she is fitted out she will be sent around the Horn to the Atlantic coast where she will be permanently stationed as a training ship for new men enlisted in the navy. She will be commanded by Commander J. M. Hawley, who has been in charge of the recruiting division of the bureau of navigation for many months past. In every way possible the appearance of this historic boat has been preserved.

As previously stated the Hartford's most famous engagement was the battle in Mobile bay, when Farragut was lashed to the mast. The manuscript account of this engagement in the files of the navy department is the most laconic thing imaginable.

TRANSPORT SERVICE OF THE UNITED STATES ARMY.

ITS SPEEDY ORGANIZATION THE WONDER OF THE WORLD.

BY THE SPECIAL WASHINGTON CORRESPONDENT OF THE REVIEW.

It can truly be said that the transport service of the United States government is the wonder of the world, and no end of credit is due to the quartermaster general's department for the speedy organization of the service. It must be remembered that it is the first time in its history that the United States has operated a line of transports, and the manner in which the officials have surmounted every difficulty is truly marvelous. The remarkable success which has attended the trips of the remodeled transports Grant, Sherman and Sheridan from New York with reinforcements for Gen. Otis at Manila has caused universal comment and has showered upon the war department no end of praises from other nations.

The great success achieved by the quartermaster's department in the construction of the troopships Grant, Sherman and Sheridan has induced the war department to increase the number of such ships. Three of the largest army transports which were used on the West Indian station during and after the Spanish war have been selected for this purpose and are now being remodeled into troopships. These are the Logan, Meade and Thomas. The two first named are now in process of refitting and renovating in Brooklyn, and the Thomas is being remodeled at the Cramp ship yard, Philadelphia. Notwithstanding the extensive character of the alterations being made to the ships, it is expected that they will be completed and ready for the transportation of troops to the Philippines by Nov. 1 at the latest. The three vessels have an aggregate capacity of 5,000 men. It is contemplated that each vessel will carry one entire regiment and one battallion of another regiment with ample room for the wives and families of the officers and non-commissioned officers.

In fitting up the transports the officials of the quartermaster's department worked out the problem for themselves. Advantage was taken, of course, of the experience of other nations in transporting troops, but the accommodations provided for the comfort and health of the soldiers represent new ideas, and the American innovations have all been found improvements.

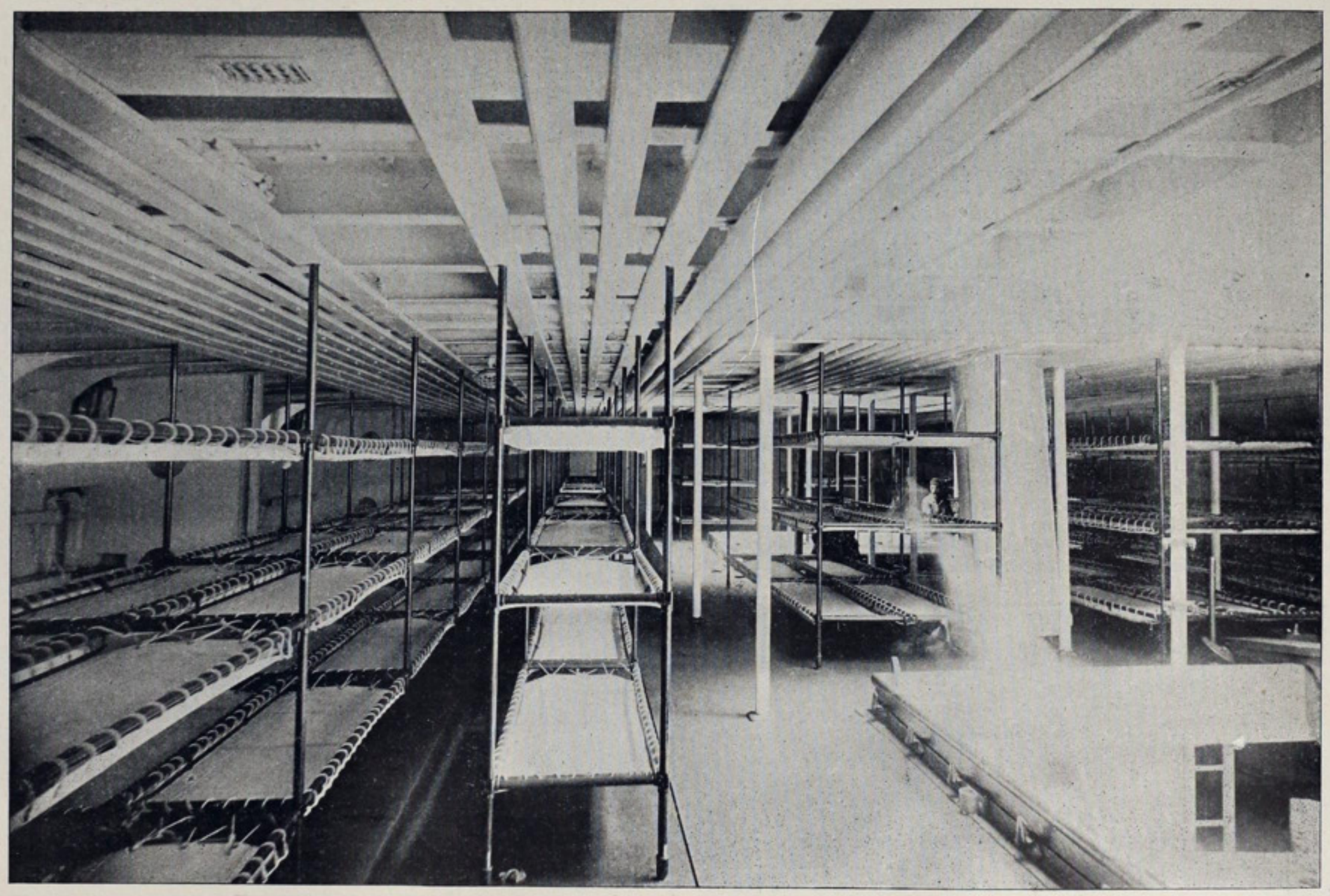
When war with Spain proved inevitable and preparations for hostilities were undertaken, nearly all the divisions of the war department were caught unprepared. But the tasks involved in recruiting and equipping an army were no more serious than those which confronted the quartermaster general, who was charged with the added responsibility of providing transportation for the troops that would be sent abroad for service. The new duties were mastered with a success that warranted more attention and commendation than has been bestowed. With the navy having a blanket over all the desirable vessels of American register and congress declining emphatically to relieve the emergency by granting register to foreign vessels, the quartermaster general succeeded before the end of June, 1898, in chartering forty-three transports on the Atlantic and fourteen on the Pacific, with water boats, steam lighters, ocean tugs and deck barges, but the experiences in moving troops to Santiago demonstrated that the facilities were not sufficient and fourteen large steamers were purchased and added to the transport fleet. These vessels conveyed during actual hostilities 28,195 men to Cuba, 17,460 to Porto Rico, 16,405 to Manila and 629 to Honolulu, and returned from Cuba 21,686 men and from Porto Rico 5,541, in addition to the 2,920 civilian employes transported. Since the close of hostilities with Spain there have been transported to and from Cuba about 42,000 men; to and from Porto Rico about 15,000 men; and from the Philippines about 5,600 men, making a total movement of 155,436 men. This, however, was only a temporary service. The vessels had been prepared for the accommodation of troops during the emergency, but the fruits of the war entailed new duties upon the quartermaster general's department. The acquisition of Porto Rico and the Philippines and the temporary occupation of Cuba necessitated the establishment of a permanent system of ocean transportation, and when Aguinaldo and his followers opened fire upon the American troops, starting a rebellion which required the forwarding of reinforcements to Gen. Otis. the work that had been done in the way of providing a fleet of transports was given a trial.

WHAT THE FLEET CONSISTS OF.

The transport fleet of the United States now consists of eighteen vessels, all purchased from steamship companies with the exception of two, the Panama and the Rita, which were captured by the navy and bid in by the department when sold as prizes of war. All these vessels have been remodeled and refitted or are now in course of transformation. In addition to the transport fleet chartered for the Cuban and Porto Rican campaign, a fleet of chartered steamships was fitted out in the early summer of last year for the transportation of troops from San Francisco to Manila. For this movement there were chartered seventeen large and commodious ocean steamships. As this involved a voyage of over 7,000 miles—a portion of it through a tropical clime—it was necessary that the ships in which the troops were to make this long voyage be specially fitted with a view to the health and comfort of the men. There have been carried from the United States to Manila about 17,000 men and the reports show that this army was delivered at Manila without a single mishap and the men in condition for active operations as soon as they had disembarked. Since then nearly all of the original army of volunteers has been returned to the United States. There is now an army of 31,000 in the Philippines and an additional army of 30,000 is en route. This shows in a measure the immense labor of the transport department. Nearly 100,000 men have or will be transported.

Twenty-three of these chartered transports, not including the animal ships, are still in the Philippine service, and in addition two large steamers, the Hancock and the Warren, have been elaborately fitted up.

The three transports, Grant, Sherman and Sheridan, are at present the pride of the quartermaster's department, though as stated the department expects to surpass them in the Logan, Meade and Thomas. The Grant, Sherman and Sheridan have a gross tonnage of 5,558, 5,780 and 5,673 tons respectively and have been completely overhauled and remod-



SLEEPING ACCOMMODATIONS ON BOARD ONE OF THE NEW UNITED STATES ARMY TRANSPORTS.

eled. The Sheridan, before refitting, carried eighty officers, 1,000 men and 1,000 animals and on one trip from Newport News to Porto Rico even exceeded this record by carrying forty-three officers, 1,130 men and 1,005 horses and mules. These vessels have bilge keels, which steady them considerably while at sea and materially increase their value as transports. On their trips from New York to Manila, the Grant carried a total of 1,758 persons and the Sherman a total of 1,799. The Sherman on short trips from Savannah to Havana has carried ninety officers, 2,082 men and twenty-five animals, besides forage, subsistence and quartermaster's supplies for sixty days.

HOW THE PRINCIPAL SHIPS ARE EQUIPPED.

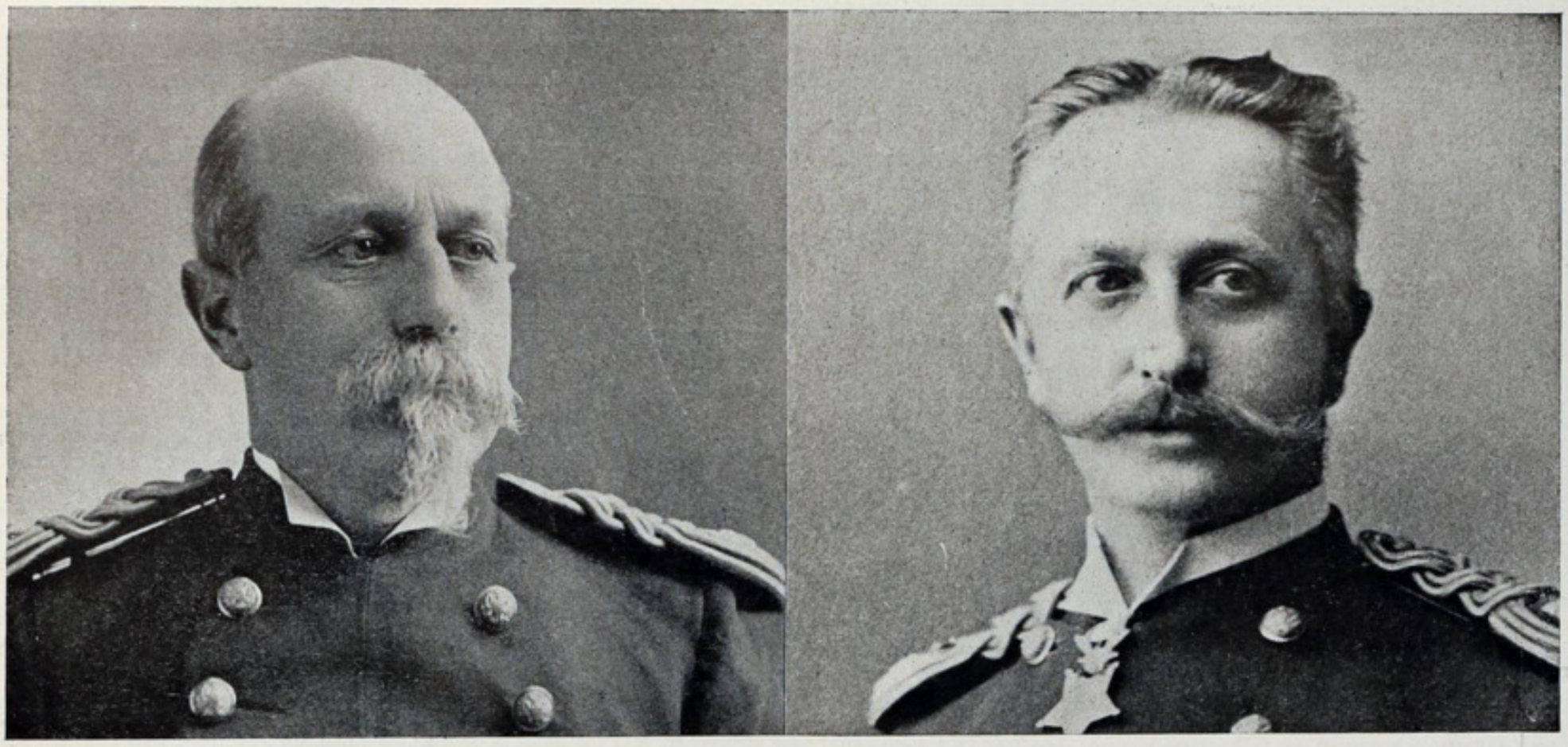
These ships embody many new features and are unqualified successes. The hulls and decks of the ships were not changed but were thoroughly renovated and repaired. Each has four decks besides the hold and the bridge—spar, main, 'tween and orlop decks. On the bridge deck, in addition to the pilot house and captain's cabin, the quartermaster has his office and there is a pantry, a locker and twenty-four staterooms for officers. The forward part of the spar deck is open and offers a promenade and place of exercise for the officers and men. The center of the deck from amidship toward the stern is given over to a large saloon, where the officers' meals are served; adjoining is a pantry, and separated by an aisle is a store room and linen closet. Back of the funnel there is a galley and another linen closet, the officers' social room and staterooms for the chief engineer and his six assistants. On one side of the ship, separated from the saloon by an aisle, are toilet and bath rooms, a pantry, the bakery and thirteen staterooms. On the opposite side of the saloon, also separated from it by an aisle, are fifteen staterooms and a storeroom. There are four hatches on the forward part of this deck and two in the space between the superstructure described and the wheel house and lavatory, which occupy the stern.

The main deck has in the bow, quarters for the firemen, coal passers, seamen, oilers and watertenders. The lamps and paints are kept on this deck forward of the carpenter shop. The donkey man and mate, the boat man and mate, the carpenter and mate, quartermaster, baker, steward, pantryman, scullions, stewards and mess boys have quarters here, adjoining baths and toilets. There is considerable clear space between these quarters and the coal hatches, which are in front of the firemen's and seamen's wash places. Back of the space reserved for the boilers and engines is refrigerating machinery and engineer's stores. These occupy the center of the deck amidship. On one side, opposite the engines and boiler spaces, are mess rooms respectively for the seamen, firemen, coal passers, the petty officers, oilers and water tenders. On the other side is the steam galley and scullery. Back of the oilers and watertenders' mess is the electric generator, stores and refrigerator. Back of the refrigerating machinery is a 600-gallon fresh water tank and engineers' stores. Adjoining the scullery the cabin stewards have their mess.

The hospital is on this deck in the stern but separated from these compartments. It is equipped with all modern appliances. It has sixty-four separate hospital bunks and is surrounded by the dispensary and stores, the surgeons' rooms and staterooms for the hospital stewards. The perfection of the hospital has been especially commented on by the medical officers abroad who have had an opportunity to inspect it. The clear spaces fore and aft on this deck are provided with swinging tables and stools for messing the enlisted men. These tables are so arranged that when not in use they are swung out of the way, leaving a clear space for the exercise of the men. Also upon this deck there is an organ with books and hymns and songs for use in religious and other service.

The next deck, known to the initiated as 'tween decks, is given over to the troops, and here the ingenuity of the quartermaster's department has been demonstarted to its greatest degree. In the foreign service it is the general practice to give soldiers on transports the sailor's bunk—that is the hammock—but our new transports have been fitted up with a regular bunk. It is a structure made fast to the deck, three tiers high and composed of gas pipe. The soldiers sleep on canvas, each man having his individual strip, which is tied to the framework of the bunks and can be readily removed for airing or washing. The bunks are also removable and may be taken down whenever it is desired to have the unobstructed space for the exercise or amusement of the men. Aisles are liberally distributed between the tiers of bunks, which are in no case more than two men deep. These sleeping accommodations are arranged to economize space to the greatest degree possible in placing the men in hammocks three layers deep.

On these decks accommodations are provided for 1,212 soldiers. They



F. B. JONES, MAJOR AND QUARTERMASTER, U. S. A.
CHAS. BIRD, COLONEL AND QUARTERMASTER, U. S. V.

OSCAR F. LONG, CAPT. AND A. Q. M., U. S. A.
BRIG. GEN. M. I. LUDINGTON, QUARTERMASTER-GENERAL.

The Men who Organized and Direct the Great Transport Service of the United States Army.

are not all in one room. Bulkheads have been thrown across the ship, dividing it into communicating compartments, which may be made watertight should occasion require. In the extreme bow, rooms have been provided for the seamen and firemen where they may retreat when off duty for amusement.

The next, or orlop, deck has berth accommodations for 924 men. The boilers and engines again occupy the space amidship and a quantity of coal is stored on this deck in front of and alongside the boilers and engines. Forward there are three large rooms fitted up for the troops. Aft of the engines is a large coldroom and icehouse and stores. The fourth trooproom on this deck is at the stern with 198 berths. The magazine is in the extreme stern.

SUPPLIES AND EQUIPMENTS IN THE HOLD.

Below deck in the hold are the supplies and equipments. For this purpose the hold is divided into six compartments, the forward four being occupied principally by officers' and company equipments, ambulance wagons and ammunition. There is a place for everything, and the supplies carried in the compartments are stored so as to be readily obtainable. In one the barrels of beef are first placed and a flooring laid over them upon which the barrels of pork are placed and on top of all barrels of hard bread. Adjoining the filed ranges are first stored and barrels of hard bread placed on top. These are about the only ration supplies carried forward. The quartermaster's supplies of clothing, hats, shoes, etc., have a place; also the household headquarters and gymnasium furniture. The arrangement of the two aft compartments is practically perfect. Electric lighted aisles penetrate them and everything from a cake of soap to a barrel of flour has its particular place.

Some experts contended that it would be impossible to transform the steamers constructed for carrying freight into troopships. In this respect the greatest obstacle to overcome was the ventilating. It was urged by some that soldiers put on the orlop and 'tween decks could not survive a trip half way across the globe. A system of ventilation was installed that has proved entirely successful. Four large steam fans were placed on the spar deck and connected, (fitted with air coolers, cleaners and heaters, distributing pipes, ducts and registers), to all spaces occupied by the troops—hospital, toilet rooms, pantries, forecastle and in fact all rooms except those on the bridge deck. The registers in the ventilating pipes are operated at the will of those occupying the room, and by forcing the air over coils of steam pipes it is heated when desired. This is necessary aboard a ship traversing various zones. Fifty additional side ports with shutters were placed in the refitted transports and a complete electric system of about 550 lamps was introduced. About one hundred enameled wash basins of the latest pattern, both tubs and shower baths in abundance were scattered about the ship and salt water supplied to them. The transports in making the run from New York to Manila had to coal four times, but by experience the officers will soon learn various ways in which the fuel may be economized. The Hancock and Warren, now on the Pacific, will be joined by the Grant, Sherman and Sheridan, and regular and frequent communication established between Manila and San Francisco. The transports will take coal at both ends of the run and also at Honolulu, where the coal pile of the navy will be used and paid for by the war department.

The remarkable success attained in the speedy organization of the transport, if due to any one man, is due to the intelligent direction and untiring work of Col. Charles Bird, who has been for some years in charge of the transportation department of the quartermaster general's office. The brunt of it fell upon his shoulders and he has borne it well. Credit is also due to Col. F. B. Jones, the general superintendent, and his officers in New York, and to Col. O. F. Long in San Francisco for the manner in which they have carried out the instructions of the quartermaster general's office.

The transport fleet of the United States government today is as follows:

VESSELS OWNED BY THE GOVERNMENT.

Old Name.	New Name.	Capacity, Men.
Arizona	Hancock	1,200
Berlin	Meade	1,200
Chester	Sedgwick	1,200
Clearwater	Ingalls	150
Manitoba	Logan	1,800
Massachusetts	Sheridan	1,800
Michigan	Kilpatrick	800
Minnewaska	Thomas	1,800
Mississippi	Buford	650
Mobile	Sherman	1,800
Mohawk	Grant	1,800
Obdam	McPherson	850
Panama	Hooker	
Port Victor	McClellan	800
Rita	Burnside	250
Roumanian	Crook	1,000
Scandia	Warren	1,224
Bay State	Wright	200

HOSPITAL SHIPS.

Relief, Missouri, Terry.

TUGS.

Ord, Weitzel, Reno, Richardson, Sumner, Reynolds, Poe.

STEAM LIGHTERS.

Slocum, Kearney, Williams, Baker, Canby.

PACIFIC—SHIPS FOR CARRYING ANIMALS.

Name.	Capacity, Animals.	Name.	Capacity, Animals
Tacoma (sailing ship)	206	Aztec	400
Conemaugh	295	Garrone	411
Lellanaw	286	Port Albert	519
Wyfield	140	Victoria	417
Centennial	286	Siam	325
Athenian	411	Lennox	400

CHARTERED VESSELS ON THE PACIFIC—TROOPSHIPS.

Name.	Capacity, Men.	Name.	Capacity, Men
City of Sidney	850	St. Paul	850
Zealandia	600	Charles Nelson	550
Senator	713	Tartar	1,200
Morgan City	600	Belgian King	800
City of Para	1,000	Tacoma	550
Indiana	900	Glenogle	800
Ohio	724	Columbia	600
Valencia	500	Elder	600
Newport	500	Victoria	800
City of Pueblo	820	Olympia	700
Pennsylvania	1,200	City of Rio Janerio	775

PRIZES CAPTURED DURING THE SPANISH WAR.

IN NEARLY EVERY CASE CONTESTED QUESTIONS BETWEEN THE OWNERS AND THE GOVERNMENT ARE STILL UNSETTLED.

BY F. H. MORRIS, NAVY AUDITOR OF THE TREASURY.

As regards the condition of the prizes captured during the Spanish-American war, it may be said that in nearly all cases the contested questions between the owners and the government are still unsettled, and are, nearly all of them, in the court of claims for adjudication. This is particularly true in the case of the Manila and Santiago fights, involving bounty which is paid at the rate of $100 a head if the opposing force is inferior, or $200 if the contesting force is superior to ours. Naval officers claim, in each case, that the land batteries should be calculated, and that the Spanish force was superior to the American, and ask $200 per head. All legal and executive questions of this kind have been referred to the court of claims, and it is not thought that they will be disposed of for a very long time, possibly two or three years. There have been but three claims adjudicated and ordered for distribution, as follows:

The Restormel captured by the St. Paul—Sale in this case amounted to $13,025.14, one-half, $6,512.57, going to the government, and the other half for distribution to the officers and sailors. Of this latter the auditor for the navy department has paid $4,063.85.

The Dolores, captured by the Eagle—Sale in this case amounted to $859.02, of which the United States received $429.51. Of the one-half ($429.51) for distribution to the officers and sailors, the auditor for the navy department has paid $128.16.

The Twickenham, captured by the St. Louis—Sale amounted to $1,076.12, of which the United States received $538.06. Of the one-half ($538.06) for distribution to the officers and sailors, the auditor for the navy department has paid out $35.68.

All claims for these three, thus far made, have been settled. There are a great many thousands of claims on file asking for their shares of the various different prizes which will have to wait for the decision of the courts.

In answer to the request for my opinion regarding the prize money system, I have no hesitancy whatever in saying that the whole system is a serious mistake and pertains very closely to piracy. If the officers and sailors of the civilized navies do not do their work because it is their duty, they certainly won't because of any mercenary motive. The whole system should be abandoned absolutely.

The laws of the navy and marine corps, covering the subject of prize money are as follows:

"All prize money adjudged to the captors shall be distributed in the following proportions:

"First—To the commanding officer of a fleet or squadron one-twentieth part of all prize money awarded to any vessel or vessels under his immediate command.

"Second—To the commanding officer of a division of a fleet or squadron on duty under the orders of the commander in chief of such fleet or squadron, a sum equal to one-fiftieth part of any prize money awarded to a vessel of such division for a capture made while under his command, such fiftieth part to be deducted from the moeity due to the United States, if there be such moeity, otherwise from the amount to be awarded to the captors; but such fiftieth part shall not be in addition to any share which may be due to the commander of the division, and which he may elect to receive as commander of a single ship making or assisting in the capture.

"Third—To the fleet captain, one-hundredth part of all prize money awarded to any vessel or vessels of the fleet or squadron in which he is serving, except in the case where the capture is made by the vessel on board of which he is serving at the time of such capture; and in such case he shall share in proportion to his pay with the other officers and men on board such vessel.

"Fourth—To the commander of a single vessel, one-tenth part of all prize money awarded to the vessel under his command if such vessel at the time of the capture was under the command of a commanding officer of a fleet or squadron, or a division, or three-twentieths if his vessel was acting independently of such superior officer.

"Fifth—After the foregoing deductions the residue shall be distributed and proportioned among all others doing duty on board, including the fleet captain, and borne upon the books of the ship in proportion to their respective rates of pay in the service."

Naval Constructor Hobson has reported to the navy department that three new gunboats now under repair at Hong Kong will be ready for service at Manila by Oct. 1. These vessels are the Spanish warships raised in Manila bay, and sent to Hong Kong for general rehabilitation preparatory to assisting in the blockade work of the islands. Thousands of dollars have been expended on each, and with new batteries and modern engines they are expected to be most serviceable ships.

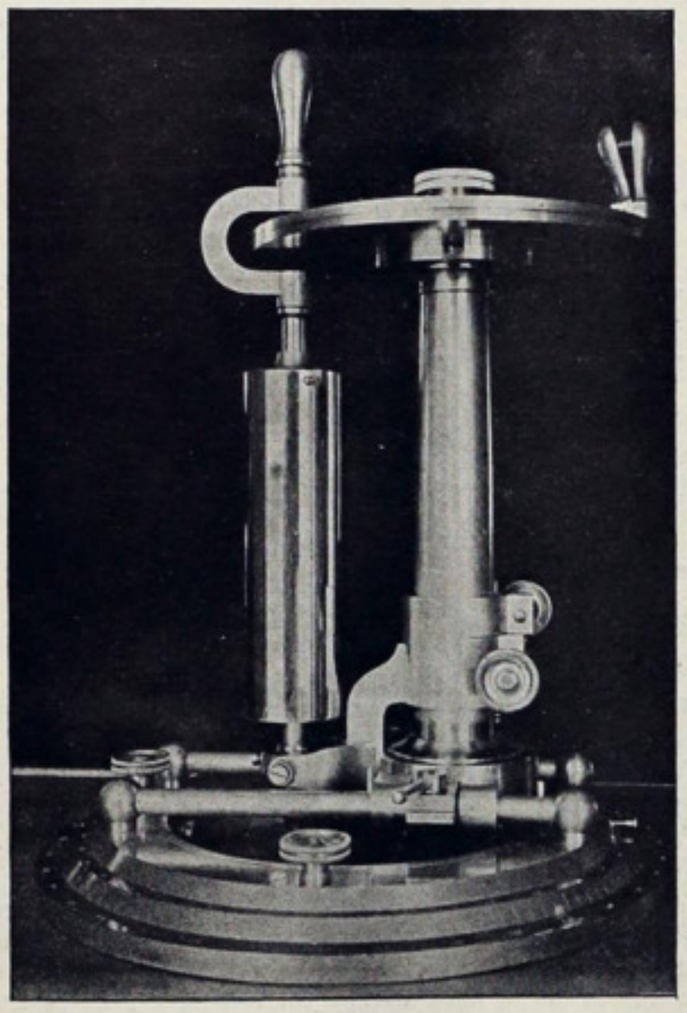
Secretary Root of the war department has received assurances that the number of transports secured will insure the arrival of all the newly enlisted troops in Manila before Christmas.

WORK OF THE UNITED STATES HYDROGRAPHIC OFFICE.

A BRANCH OF THE NAVY DEPARTMENT.

There are very few people indeed who have any appreciation whatever of the immense labors of the hydrographic office in its various departments of chart construction and chart supply, marine meteorology and sailing directions. It would be well to begin with the division of marine meteorology, for it is upon this that the work of the whole service is based. To put it in a few words, its purpose is to obtain an instantaneous meteorological picture of the earth. The weather reports from which its charts are compiled are supplied by 1,900 volunteer observers classified as follows in the merchant marine: 1,127 British, 352 American, 150 German, 79 Norwegian, 43 Dutch, 23 Belgian, 19 French, 18 Italian, 15 Japanese, 14 Danish, 9 Russian, 7 Swedish, 5 Spanish, 4 Chilian, 2 Austrian.

The captain of each one of these ships takes an observation daily. Every observation is taken at noon, Greenwich mean sun time. The captain is supplied with a table, which shows him exactly when it is noon in Greenwich no matter in what part of the earth he may be. The result of this is that an accurate picture is taken of the weather conditions of the oceans at a given moment. The captain first notes the floating ice and derelicts at sea and then the temperature, and condition of sea, sky and wind. This he forwards to the hydrographic office at the earliest opportunity. If he happens to pass a steamer coming directly to the United States he intrusts his report to the captain, as this would be the quickest way of reaching the home office. If he meets no steamer he leaves it in charge of the United States consul at the first port. It is from these reports that the daily chart is made; and at the end of the month the daily



COMPASS CUTTING MACHINE.

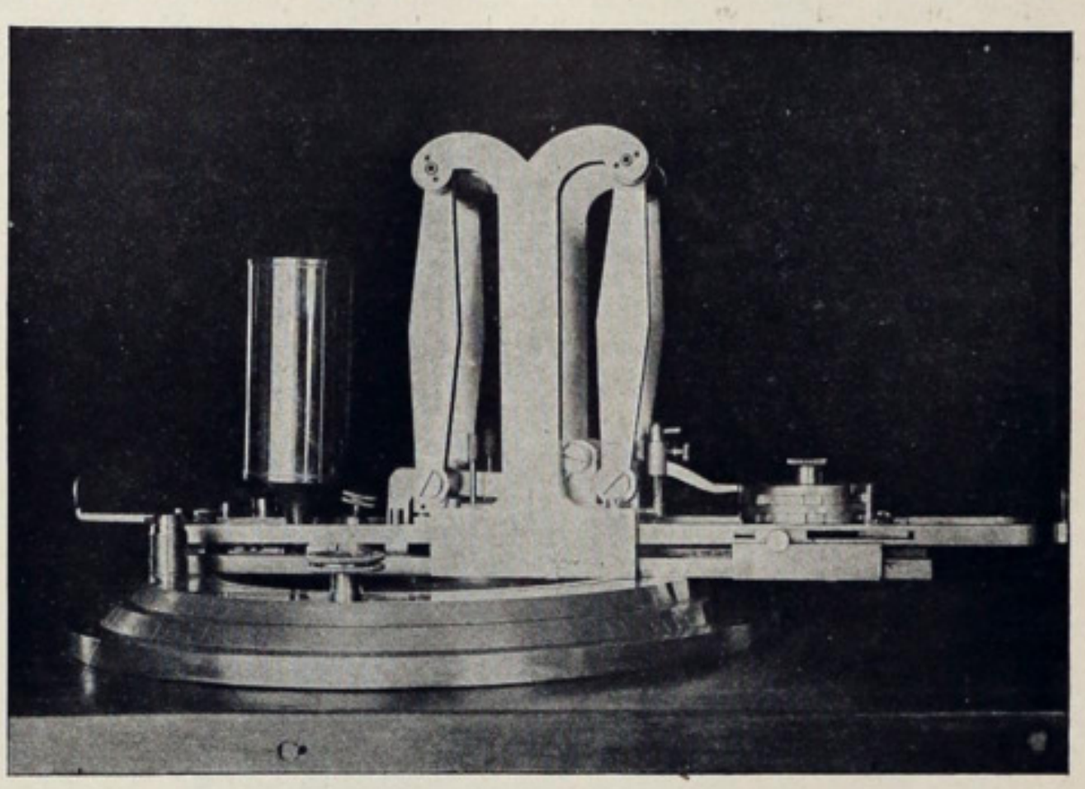
charts are compiled into one monthly chart which is published and circulated. It is sent free to all those who make observations.

These monthly pilot charts are of extreme value to the navigator. They have indeed a great educational value to the shipmaster. Every captain is anxious to make the best possible passage from port to port. The captain, if he is weatherwise, notes the condition of sea, sky, barometer and wind, and knowing what the combination means shapes his course accordingly. No shipmaster is desirous of running into a storm.

The monthly pilot chart is as complete a summary of prevailing winds, currents and weather as it is possible to give. Even the fogs encountered are indicated on the chart in a sort of reddish haze and a prediction given as to where they are likely to be encountered during the coming month. While no one can forecast a month, the condition of the climate is pretty clearly indicated.

The hydrographic office publishes 3,700 charts monthly and issues 2,400 bulletins each week. This bulletin service is a sort of supplemental service to the chart and is really a little newspaper. Owing to the small scale to which the pilot chart is necessarily limited, much nautical information received at the office, especially such as concerns coasters, is omitted. The hydrographic bulletin supplies such omissions by giving an account of dangers and obstructions along the coast and the principal ocean routes, and publishing other matter relating to navigation of interest to seamen. The bulletin is compiled in the division of marine meteorology from reports received by branch hydrographic offices, maritime associations, the light-house board, coast and geodetic survey, revenue marine, life saving service and weather bureau. It is posted in all the seaboard cities where it may be seen by masters of vessels. It is particularly valuable in warning navigators of the location of icebergs and derelicts. Mr. Robert Lee Lerch, who has charge of the meteorological division, compiles the matter for the bulletin the first thing each morning, since it is in the nature of a fresh service.

The division of sailing directions has become a most valuable branch of the service. This division embraces the entire world and includes notices to mariners of all changes in buoys, bars and depths of water. It includes a comprehensive write-up of the various harbors and ports of the world with guides into them and out of them. The reports are compiled from the observations of army engineers, naval officers and the mariners themselves. There is a wonderful fraternity among seamen which exists

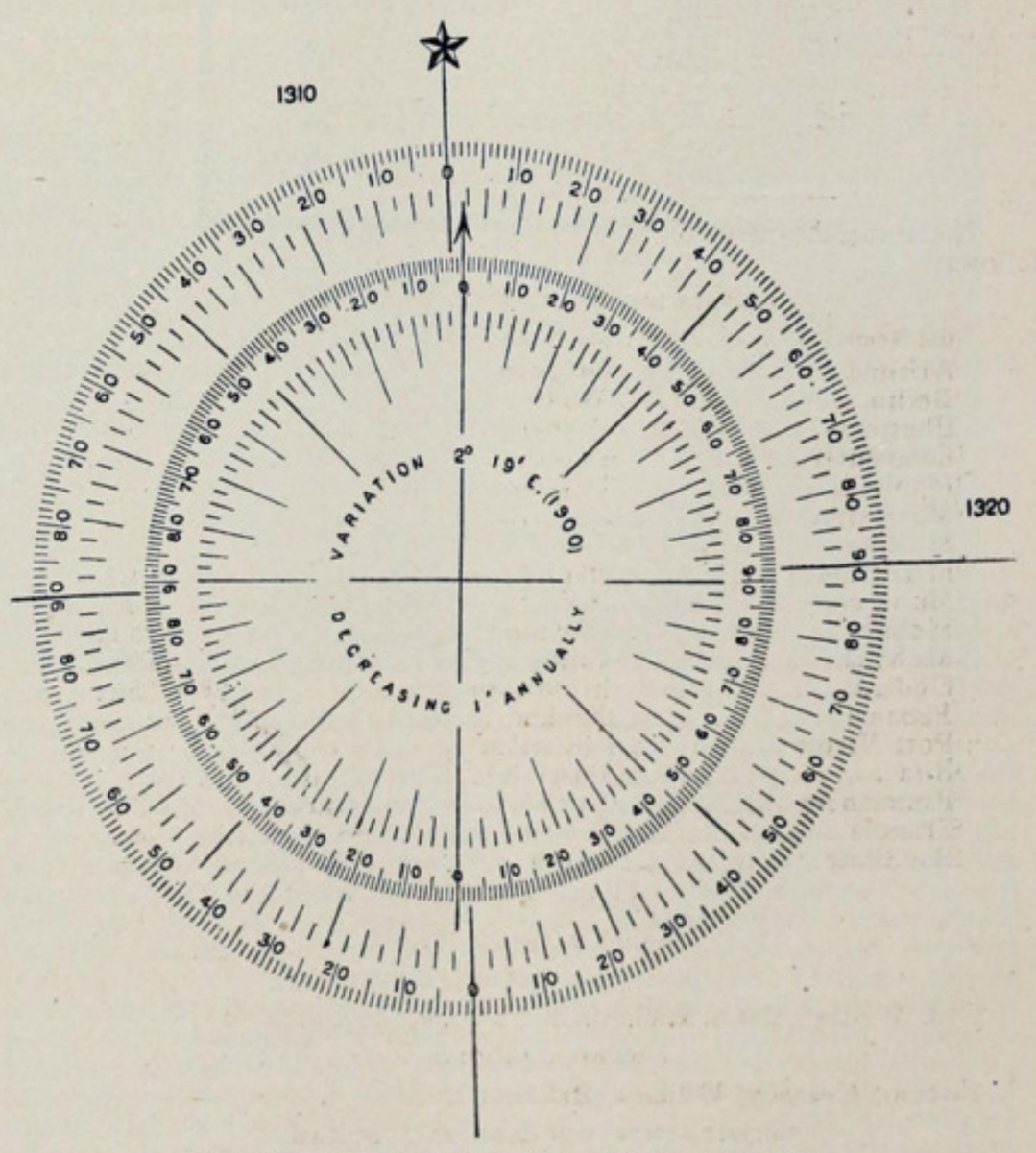


COMPASS ENGRAVING MACHINE, HYDROGRAPHIC OFFICE.

among no other class of people. No information which will aid the other is ever withheld.

USE OF OIL FOR CALMING THE SEAS.

The use of oil for calming the seas was re-introduced in the hydrographic office twelve years ago by Capt. J. R. Bartlett, now retired, but who had charge of the signal service along the coast during the Spanish-American war. He knew that the practice of calming the seas with the



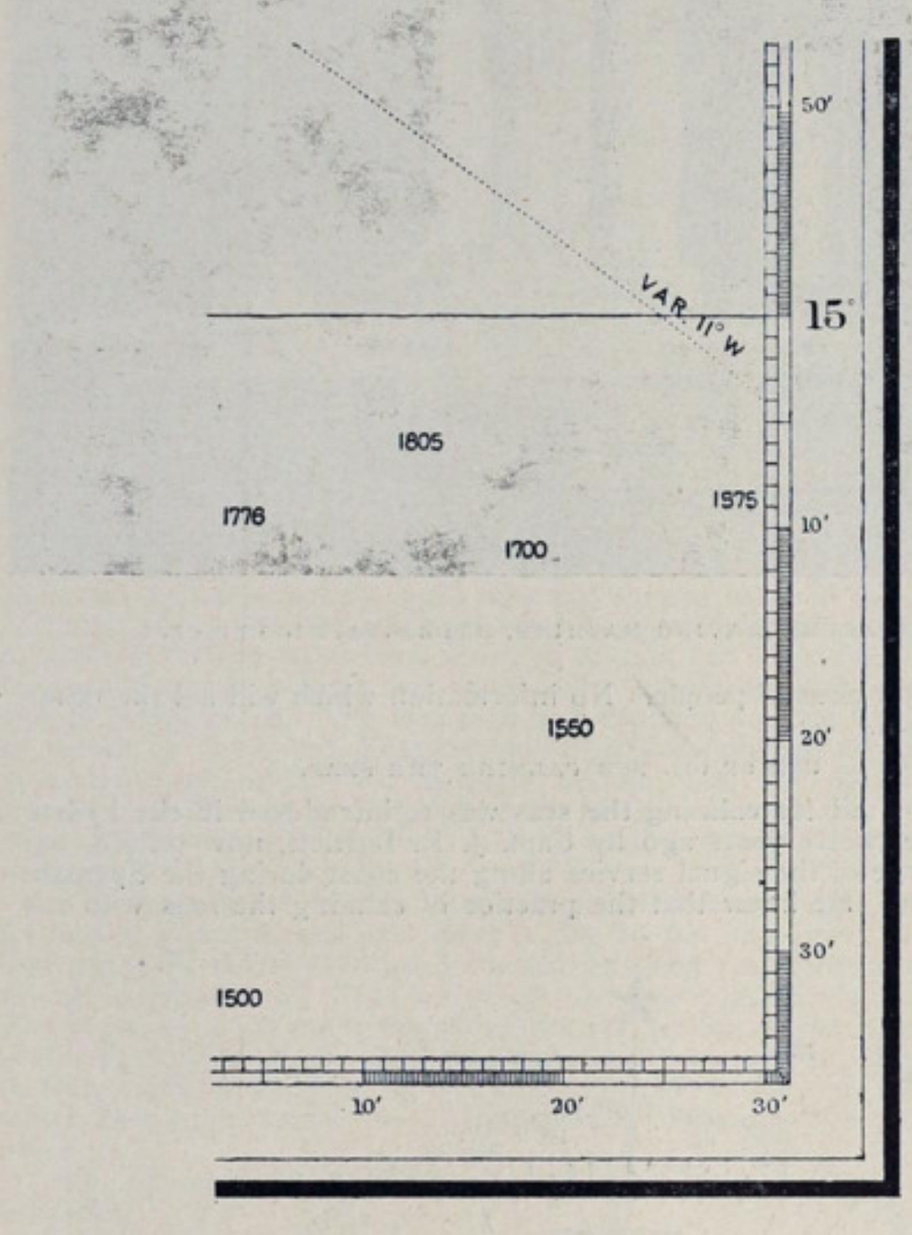
ENGRAVED BY THE COMPASS CUTTING MACHINE.

use of oil was regarded as a delightful ancient myth, but nevertheless he felt that an aid to navigation was being neglected. He made a few experiments and found that fish oil, which has marked cohesion between its molecules, stopped a tumbling sea and converted it into a gently rolling one. The use of a gallon of oil an hour is quite efficacious in quieting a sea. Indeed underwriters now stipulate in their policies that oil shall be used.

Couves manufactures a special sea quelling oil and the scientist Richter has lately devised an oil which has excellent properties for quieting a troubled sea.

It was Lieutenant Maury, superintendent of the United States naval depot and observatory from 1844 to 1861, who gave the impetus to chart making. It was he who started to compile charts from the log books of men of war and merchant vessels, to show the prevailing winds and currents, their limits and general characteristics, the best sailing routes, the limits of fog, field ice, icebergs and rain areas, all the physical features of the ocean, the feeding ground of whales and all facts of interest or value to mariners. This chart development has had its culmination in the production during the past year of the most complete chart in the world, which gives the shortest sailing distances from every known port on the globe.

It was Maury's plan which the maritime conference held at Brussels for devising a uniform system of meteorological observations at sea adopted. The form of observation to be taken by men of war and merchant marine is the same today as it was then. The form consists of a series of columns, on which are recorded the ship's position, the direction and rate of current, observed magnetic variation, direction and force of the winds, barometer with attached thermometer, dry and wet bulb thermometers, forms and direction of clouds, proportion of clear sky, hours



CUTTING AND SHADING THE BORDER.

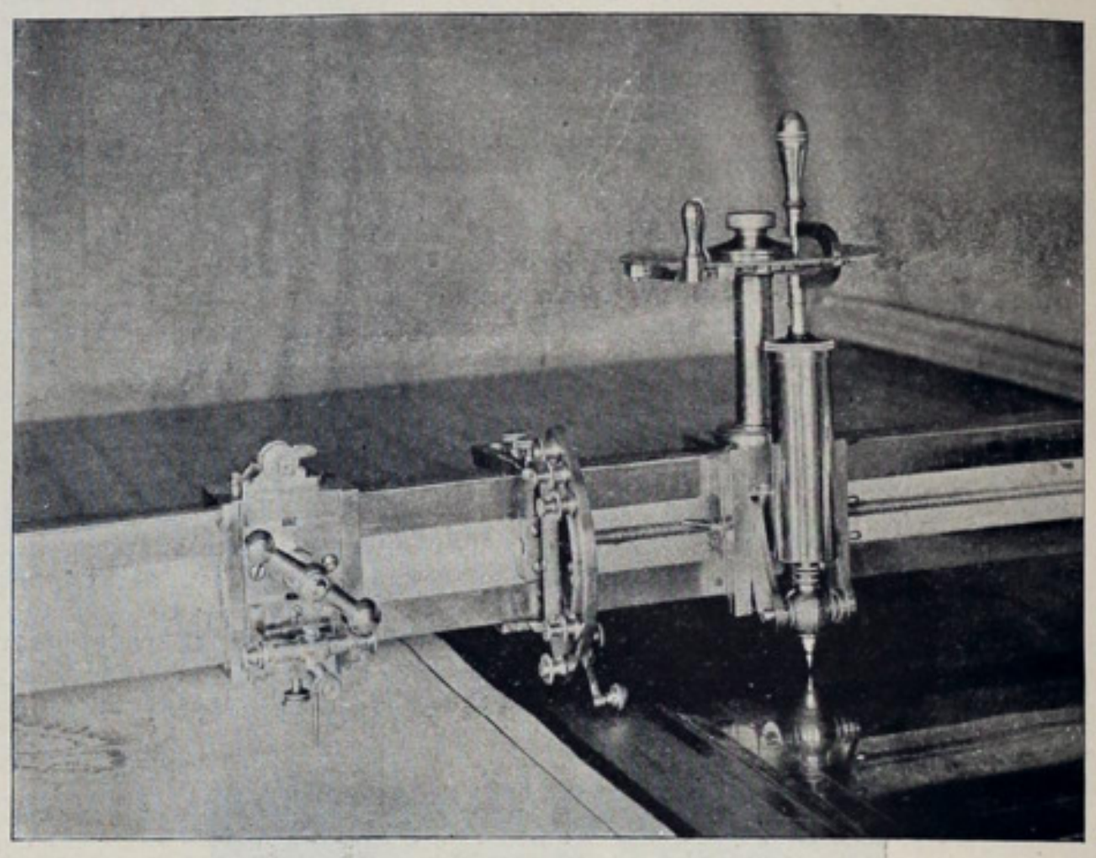
of fog, rain, snow, hail, state of the sea, water temperature at surface and at depths and its specific gravity, and the state of the weather, with an additional column for general remarks. The result of the conference was the establishment of meteorological observations throughout Europe and all over the world on a uniform scale on land as well as on sea.

DIVISION OF CHART CONSTRUCTION.

Today under the direction of Capt. J. E. Craig, hydrographer, the division of chart construction prints the charts, the division of sailing directions supplies the hydrographic information for the pilot charts, and the division of charts gives notice of the charts published, cancelled and extensively corrected. The branch hydrographic offices issue the forms and publications to mariners, receive and forward their reports, compare and correct their instruments, and by personal visits to vessels in port secure the co-operation of additional observers. The following is a list of reports received: Trade winds, ice, wrecks, fogs, buoys adrift, whales, meteorological journals, storms, Greenwich noon observations, the use of oil to still the waves, waterspouts, ocean currents, gulf stream, abstract logs, derelicts, barometer comparisons, curves of self recording barometers and thermometers, track chart of vessels' voyages, routes of transoceanic steamers, sailing routes, reports of deep sea soundings, auroras, thunder storms, electrical phenomena and general information.

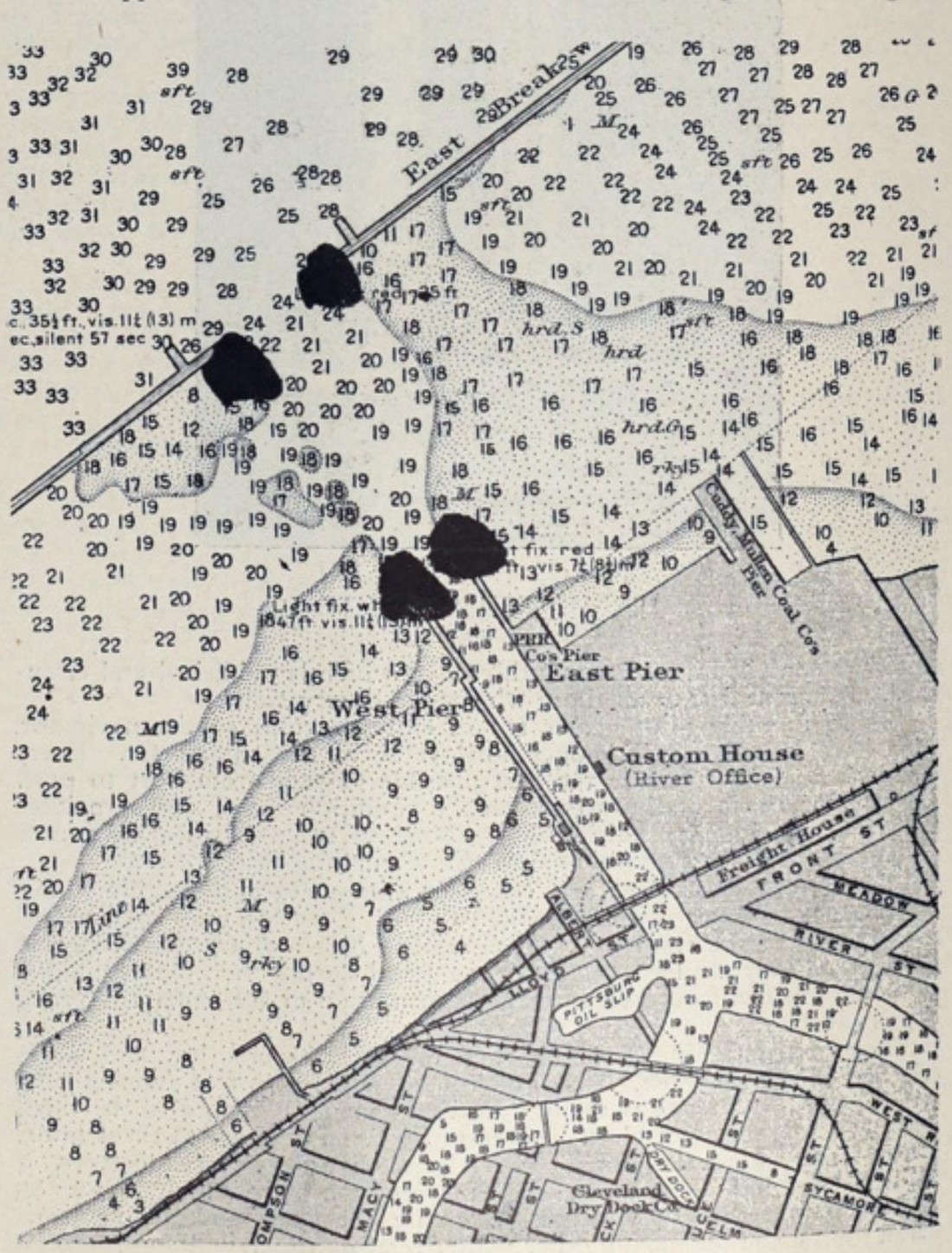
Upon the receipt of the reports the data are immediately plotted on synoptic charts, from which the pilot charts are prepared. Reports in foreign languages are translated and utilized. The pilot charts are printed in three colors. The black is a transfer on stone from a regular engraved copper plate of the mercator's chart of the ocean. The blue data consist of the meteorological forecasts and routes; they are compiled from the accumulated data on the synoptic charts of previous years and indicate the probabilities based upon experience in this month in previous years. The red text is furnished the day before the chart is published and consists of a review of the weather for the previous month up to date of publication, the storm tracks, fog limits, drifting ice and icebergs, and the position of derelicts and wreckage.

The engraving of the chart upon the copper plate by machinery is one of the most interesting things in the hydrographic service. The United States is the only nation that does its engraving by machinery. When the drawing of the chart is finished it is turned over to the engraver, who, after laying down the projection from the computation furnished for that purpose, proceeds to engrave the border of the chart. This is done by a machine about 5 feet long by about 1 foot wide, consisting of a two-rail track on which slides a carriage (about 1 foot square), which carries a graver that cuts a line exactly like a hand engraved line, only more uni-



SOUNDING ENGRAVING MACHINE, HYDROGRAPHIC OFFICE.

form. This graver is fed transversely by a micrometer screw. The machine is then set on the plate and a series of lines are engraved so closely together as to make when printed a solid black line. If the border is to be divided into longitude and latitude scales the degrees are laid off and they are in turn subdivided into six minute spaces by multipoint dividers, made in the form of a hollow cylinder, through the opposite sides of which are cut in opposite directions a series of radial slots. A post of lozenge or



ENGRAVED SOUNDINGS—WORK OF THE SOUNDING MACHINE.

square section is then inserted in the cylinder from end to end, on which is strung a series of points, each end of which passes through the slots, and when the post is turned the points recede from or approach each other, there being eleven points. When those on the ends are in coincidence with the limits of the degree, the intermediate points instantly subdivide the degree into ten spaces. Each alternate degree is then shaded.

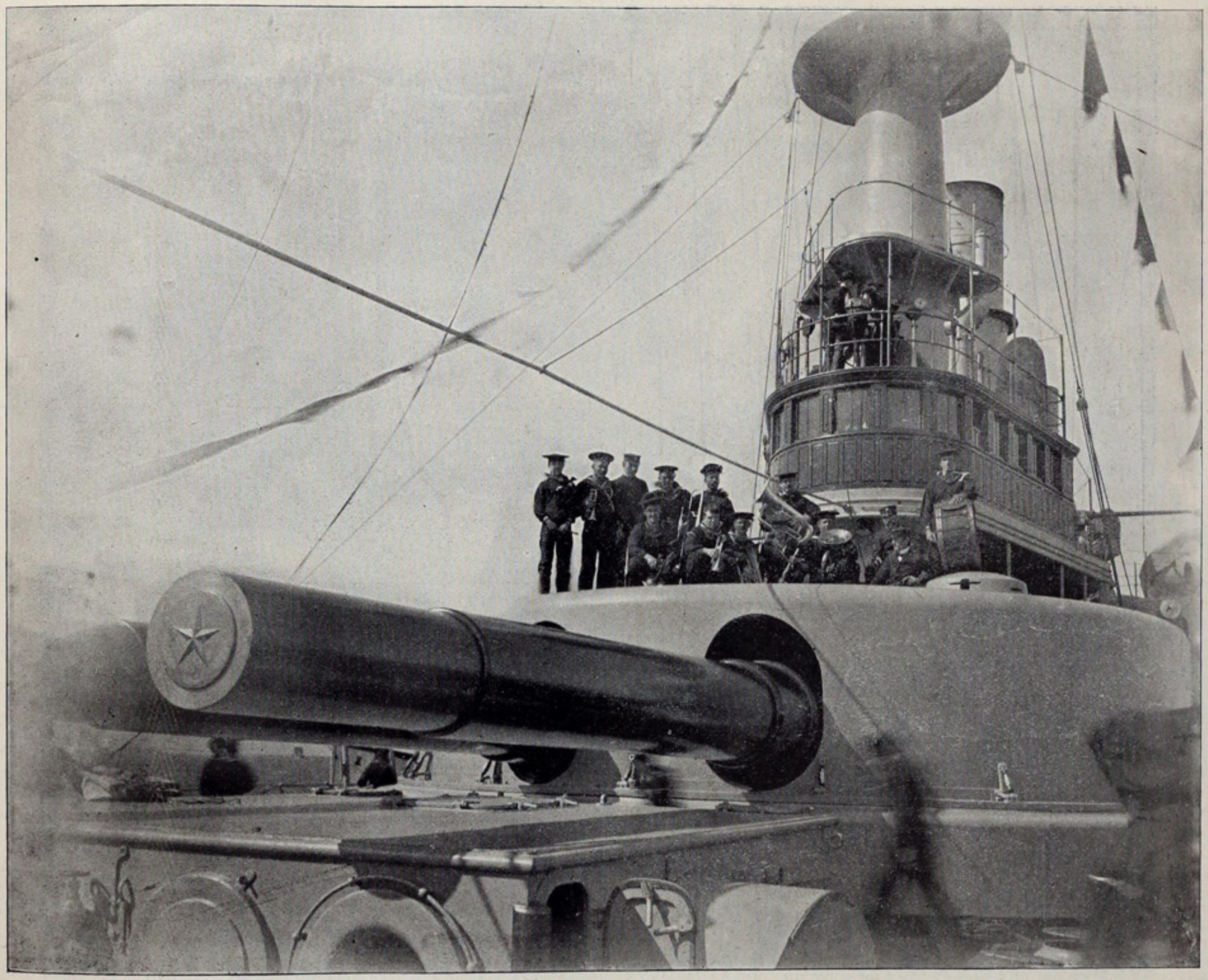
This is done by another machine, which is composed of an annolong base of about 5 feet by 2 inches, on which travels a cross track.

SPECIALLY-DESIGNED MACHINERY.

On this cross track travels a carriage which carries a rising and falling point. The machine is then set parallel to the border and by turning a handle a series of wheels and cams is set in motion, which by one operation first moves the point forward the required distance, then lowers it to the plate. The point is then drawn back, cutting a short line. The point is then raised and moved forward again ad infinitum. By another operation the carriage after each line is cut, and while the point is raised and is moving forward, is moved laterally the required distance. This gives a series of short parallel lines. The topographical engraver then takes the plate and engraves all the topographical features on the chart. It is then passed to the next engraver who proceeds to engrave the compass roses. This is done by a combination machine, consisting of an annular base, on which rotates an annular ring on a series of about 200 hardened steel balls, such as are used in bicycles. On this ring is first fitted another ring bearing the compass cutting mechanism, which cuts automatically all the different lengths of lines, the operator having only to move the arm forward or back. The following operation is followed: First, by a ratchet on the arm the turret at the back is rotated, bringing either its periphery or a slot of the required length to the front. Second a lug at the arm then lowers the point to the plate and another lug engages the tool carrier, drawing the same backward cutting the line, the length of which is regulated by a projecting point, which strikes against the periphery or enters a slot of the turret. On the forward stroke the first operation raises the point out of the cut line and from the plate; the second carries the tool forward, while at the same time the ring bearing the carrier is rotated one degree. This operation is continued until the circle of 360 degrees has been engraved. The machine is then adjusted to cut the second series of lines representing the 128 points of the mariner's compass, after which, by adjusting the annular ratchets, the machine is then adjusted to the required magnetic variation and the same operation of cutting is repeated. The ring bearing the compass-cutting mechanism is now removed and another ring bearing a lettering device is substituted, consisting of an upright bearing a longitudinally rotating pattern disc, having engraved thereon, on a large scale, such numerals and letters as may be desired, a rising and falling universal joint, through which passes the engraving point, at one end of which is the stylus, at the other the tracer, which, following the channel of the engraved pattern above, engraves on the plate below an exact reproduction in miniature of the pattern, the size of the reproduction being regulated by raising or lowering the universal joint, which is on the principle of a fulcrum.

The plate then goes to the sounding engraving machine. This machine has two side tracks, each 6 feet in length with interior racks; a cross-head, 6 feet in length, traversing the side tracks by means of a shaft, on each end of which is a pinion engaging the racks of the side tracks. On this cross-head are two carriages connected at the top of one and bottom of the other by a steel tape. The one carriage carries the lettering device of the same pattern as that on the compass machine and controlled by an endless screw with ratchet at one end, operated by a lever handle carrying a pawl. The movement of this carriage is transmitted in reverse to the other carriage which bears the stationing point by means of the steel tape. Thus these carriages move east and west in opposite directions to each other by means of the endless screw, and north and south simultaneously by the movement of the cross-head; and so any position on the chart can be instantly assumed. Now the plate is fastened to the table under the engraving carriage and the drawing in the corresponding position under the stationing point, so that when the stationing point is directly over the center of a sounding, the engraving point, when perpendicular, is directly over the corresponding position on the plate. By rotating the pattern disc the desired numeral is brought to the front, the tracer is lowered into the engraved pattern on the disc, the stylus is lowered and by means of its weight pressed into the plate, and by following the channel of the pattern the numeral is reproduced on the plate. If the sounding consists of several figures the desired spacing is obtained by a limited turn of the endless screw and the second, third or fourth figure engraved in proper order. The plate then goes to the letter engraver, after which the land surface is tinted by still another machine, which is composed of a long narrow track, on which runs a carriage bearing a small roulette of 100 points to the inch, which when drawn under weight across the plate, makes a dotted line, the lines being 1-100 of an inch apart. This is the last operation and the plate is ready to be printed from.

The machines are the invention of Vincent L. Ourdan, who has been for twenty years connected with the engraving department of the hydrographic office.



FORWARD TURRET OF THE BATTLESHIP INDIANA—BAND IN POSITION WHICH IT OCCUPIED WHEN THE VISCAYA WENT DOWN AT SANTIAGO.

HEADS OF NAVY DEPARTMENT BUREAUS.

BY THE REVIEW'S SPECIAL WASHINGTON CORRESPONDENT.

John Davis Long, secretary of the navy, is well beloved throughout the entire navy department. His most distinguishing character is his level-headedness, which enables him invariably to select the proper man for the proper place. The navy department has reached a high degree of efficiency under his direction. During the Spanish war not one word was said against Secretary Long. There was no politics in the navy.

Secretary Long was born in Buckfield, Oxford county, Maine, on Oct. 27, 1838. He received his preparatory education in the common school of his native town and in the Hebron academy, Maine. He was graduated from Hartford in 1857 and taught school for two years in Westford academy, Mass. He studied law at the Harvard law school and in private offices. He was admitted to the bar and has since practiced. He was a member of the Massachusetts legislature in 1875, 1876, 1877 and 1878, and was speaker of the house during the last three years. He was lieutenant governor of his state in 1879 and governor in 1880, 1881 and 1882. He was elected to the forty-eighth and re-elected to the forty-ninth and fiftieth congresses. He was for several years on the state house construction commission of his state. He is the senior member of the firm of Long & Hemenway. Secretary Long is one of the most popular men in the administration.

REAR ADMIRAL CHARLES O'NEIL. SECRETARY JOHN D. LONG. REAR ADMIRAL MORDECAI T. ENDICOTT.
REAR ADMIRAL PHILIP HICHBORN. HYDROGRAPHER CAPT. J. E. CRAIG. REAR ADMIRAL GEORGE W. MELVILLE.

Leading Bureau Officials of the Navy Department of the United States.

REAR ADMIRAL PHILIP HICHBORN, CHIEF CONSTRUCTOR, UNITED STATES NAVY.

Chief Constructor Philip Hichborn was born at Charlestown, Massachusetts in 1839, of a stock that contributed to the sinews of colonial independence—Deborah Hichborn being the mother of Paul Revere—and which, later, developed into one of the renowned ship building families of New England.

At twenty-one, having graduated from the Boston high school, and, by direction of the navy department received a course of special instruction in ship construction, calculation and design, supplementary to his five years' tuition as shipwright apprentice at the Boston navy yard, he sailed from Boston for California in 1860; and that tempestuous voyage of 150 days gave him an insight into the needs of nautical life which has been of inestimable value to him ever since. Two years' service at the navy yard, Mare island, carried him from an humble position in the construction department of that station to master shipwright at the age of twenty-three, in which capacity he was often called upon to assume the entire control of the department in the absence of the naval constructor.

In 1869 he entered the navy as an assistant naval constructor, and six years later, after a competitive examination, became full constructor. From that time until today his life has been one of uninterrupted activity in the immediate concerns of our naval vessels—broken once only by his tour of European dock yards, of which his report gives but a restricted idea of the scope of his investigations there—and made more exacting when he became chief constructor on July 13, 1893. He was re-appointed for a second term Sept. 7, 1897.

Recent orders of the department regarding the bureau's work raised him to dignity comparable to that of the chief of naval construction in England, and added responsibility to which he responds without the slightest tax upon his resourcefulness. His present honor is the simple sequence of a life of unremittent energy; a mind rarely fitted to its calling, supplemented by a nature of unusual strength, and a temperament and heart at once kind and generous to friends and fair to those less graciously disposed.

REAR ADMIRAL GEORGE WALLACE MELVILLE, CHIEF OF THE BUREAU OF STEAM NAVIGATION.

Rear Admiral George Wallace Melville, engineer in chief of the United States navy, is deserving of more notice than this passing sketch can give him. He is a son of Alexander Melville and Sarah Douther Wallace. He was born Jan. 10, 1841, in New York city. He was educated in the public schools of that city and later, displaying marked mechanical instincts, passed through the Polytechnic school of Brooklyn and received a further course in mathematics in a religious academy in the same city, which in that branch held high repute. When school days were ended he entered the engineering works of James Binn of East Brooklyn, where, broadly and deeply, he laid the foundations of that practical skill which has served him well in many a later hour of trial.

On July 29, 1861, when but twenty years old and only ninety days after the war began, he became an officer of the engineer corps of the United States navy. Although a junior officer, Melville saw much active service during the war. He was for a brief period on the side-wheel steamer Michigan, cruising on the northern lakes, and was transferred thence to the screw sloop of war Dakotah of the North Atlantic fleet. With her he served on the shelling of Lambert's point and the capture of Norfolk, Va., she acting as guard ship during the night and morning of the destruction of the Merrimac off Craney island, Norfolk harbor.

He was with the fleet that cleared the James river in Virginia as far as Fort Darling, Drury's bluffs. Later he was attached to the fast side-wheel steamer Santiago de Cuba, the Tonawanda, and the screw sloop Wachusett. He was on the Wachusett when she rammed and captured the confederate cruiser Florida in the port of Bahia, Brazil.

When the war was ended Melville was ordered to the Tacony and with her served in the Mexican gulf during the French occupation and evacuation of Mexico. Later he joined the gunboat Penobscot, then cruised to Brazil in the flagship Lancaster; then to the arctic in the steamer Tigress; then to China and Japan in the flagship Tennessee; again to the arctic in the steamer Jeanette, and yet again in the Thetis for the relief of the Greeley expedition. The latter duty with a short term on the Atlanta closed his service afloat. He has been for the past nine years engineer in chief of the navy.

Volumes upon volumes might be written upon Melville's indomitable pluck and absolute heroism on his arctic voyages on the Jeanette and the Thetis. Indeed his search for the dead body of De Long is one of the most sternly rugged things in history.

In his homeward journey from the delta Melville was granted a private audience by the czar and czarina of Russia at the palace of Peterhof. In New York, Philadelphia and Washington he was received with high honors. He was elected a member of the National Geographical Society of the United States, an honorary member of the Royal Swedish Society of Anthropology and Geography and a member of the Geographical Society of Philadelphia. Subsequently he was made an honorary member of the Institution of Naval Architects of Great Britain. In 1896 Stevens Institute of Technology conferred upon him the degree of doctor of engineering. In June of the present year Columbia University conferred upon him the degree of Master of Science, because of the general value and worth of his long labors as engineer in chief and particularly for the efficient work of the bureau of steam engineering during the Spanish war. Georgetown University recently conferred upon him the degree of doctor of laws. Rear Admiral Melville is at present the president of the American Society of Mechanical Engineers.

REAR ADMIRAL MORDECAI T. ENDICOTT, CHIEF OF THE BUREAU OF YARDS AND DOCKS.

Rear Admiral Mordecai T. Endicott, chief of the bureau of yards and docks, was born in New Jersey in 1844. He comes from old Puritan stock, being a direct descendant of John Endicott, the first governor of the colony of Massachusetts, who came over in the Arabella, A. D. 1628, to be the governor of the plantation. Graduating in 1868, taking the degree of civil engineer from the Rensselaer Polytechnic Institute, Troy, N. Y., he first practiced as a mining and topographical and bridge engineer in Pennsylvania, Ohio and Connecticut. In 1872 he became assystant engineer at the League island navy yard. In the same year he was transferred to the Philadelphia navy yard and was commissioned a full civil engineer, United States navy, serving later at New London, Portsmouth, League island, Norfolk, Port Royal and New York. He was government engineer of the Norfolk dry dock, which was completed in 1889. In 1890 he was appointed consulting engineer to the bureau of yards and docks. During this service he designed the Puget Sound dry dock, which is regarded as the best timber dock ever built in this country; in fact it is the only dock combining a concrete masonry entrance with a timber lining. This dock was opened in 1897, first docking the Monterey, and has since docked the Oregon twice with perfect safety both to the dock and battleship.

Mr. Endicott was appointed in 1895 by President Cleveland the naval member of the Nicaragua canal commission. This appointment was made on the recommendation of the secretary of the navy. He was subsequently selected by Secretary of the Navy Long to serve as a member of the United States armor factory board of 1897, to prepare plans and estimates for the establishment of a factory for making armor for war vessels. Among Mr. Endicott's most recent and important works may be mentioned the improvements at Key West and the construction of coaling stations at Tortugas.

REAR ADMIRAL O'NEILL, CHIEF OF THE BUREAU OF ORDNANCE.

Rear Admiral Charles O'Neil, chief of the bureau of ordnance, entered the navy in July, 1861. He received his education in the public schools of Roxbury, a suburb of Boston. Before entering the navy he made two voyages to the East Indies, and on the second voyage he was wrecked in the Indian ocean. After the vessel foundered he drifted about in a small boat for five days before he was picked up. His first service in the navy was on the sloop Cumberland, in which he participated on the attack on Fort Hatteras and Clark and in the engagement with the confederate ironclad Merrimac off Newport News, March 8, 1862. In this affair the Cumberland went down with colors flying. O'Neil was promoted for gallantry on this occasion. His next service was on board the gunboat Tioga of the James river flotilla. Later he served as navigator of the gunboat Rhode Island and took part in both attacks on Fort Fisher. His next service was in the European squadron on board the Shamrock. Later he served on the monitor Dictator and on the Dakotah, Serene, Galena, Supply, Lancaster, Wasp, Richmond and other vessels in the south Atlantic and Chinese stations. He took the Marblehead to the Keil canal ceremonies.

While on shore Admiral O'Neil has been engaged in ordnance work. He has been twice superintendent of the naval gun factory at Washington, and in a great measure its development is due to him. While he did not originate the manufacture of smokeless powder he introduced it into the navy and through his efforts a government factory for its manufacture has been established at Indian Head near Washington.

Admiral O'Neil succeeded Admiral Sampson as chief of the bureau of ordnance and during his term of office has been particularly active in making improvements. Under his direction a new and thoroughly modern machine shop has just been completed at the gun factory at Washington and the main gun shop is now extended 290 feet, which will make it 936 feet long and one of the finest shops of its kind in the world. He has also caused to be erected and equipped at the same place a fine cartridge making plant.

REAR ADMIRAL BRADFORD, CHIEF BUREAU OF EQUIPMENT.

Rear Admiral R. B. Bradford, chief of the bureau of equipment, is a native of the state of Maine and was graduated from the United States naval academy with high honors in 1865. In 1883 he superintended the installation of an electric lighting plant on board the Trenton, the first man of war to be lighted by electricity. From 1885 to 1887 he was engaged in writing the United States navy regulations, in organizing a naval department of electricity and in serving as the first naval inspector of electric lighting. In 1891-2, at the time of the threatened war with Chile, he commanded the Bennington off the coast of South America. In December, 1897, he was appointed chief of the bureau of equipment. In addition to the equipment of ships and the installation of electric appliances on board ship, the subject of coaling stations and coal supplies for the navy pertains to the bureau. While commander, Rear Admiral Bradford saw service on the following ships: Swatara, Rhode Island, Iroquois, Delaware, Wabash, Franklin, Alliance, Trenton, Bennington and Montgomery.

BRIGADIER GENERAL A. W. GREELEY, CHIEF OF THE SIGNAL SERVICE.

Brigadier General A. W. Greeley, chief of the signal service, is probably one of the most widely known men in Washington. He is an explorer of no mean fame and an author of marked ability. His volume, "Explorers and Travelers," is one of the most comprehensive accounts of the arctic regions published. His most famous expedition was that to Lady Franklin Bay, and while it ended most disastrously the scientific results obtained were of the highest value. For this service Greeley was advanced from a captaincy to a brigadier generalship and made chief signal officer of the United States army. Under his management the signal service has prospered wonderfully.

The relief of the Lady Franklin Bay expedition is one of the most stirring chapters in life. This expedition had been in the Arctic regions since Aug. 11, 1881, and having no means of transportation by sea was to have been relieved at a predetermined time by vessels from the United States. The relief ships not appearing in due season, the expedition began its retreat, which was effected in health with records and all essential food supplies to Cape Sabine in October, 1883. There, hemmed in and daily expecting succor, Greeley made what proved to be the death camp of many of his men and there the feeble and starving remnant of his heroic command was rescued in June, 1884, by the Thetis and Bear. Greeley's expedition indeed "failed not in aught entrusted to it" and perished really through the faults of others. The expedition could have been relieved nearly a year before it was relieved.

CAPTAIN JOSEPH EDGAR CRAIG, CHIEF HYDROGRAPHER.

Captain Joseph Edgar Craig, chief hydrographer, was born in New York and was appointed an acting midshipman at the Naval Academy, Nov. 9, 1861. He was promoted to midshipman July 16, 1862, and was graduated in 1865. He was on the Monongahela in the West Indian squadron from November, 1865, to July, 1868. He was promoted to ensign Dec. 1, 1866, and promoted to master March 12, 1868. He became a lieutenant in 1869. He was assigned to special duty as astronomer in the North Pacific survey in November, 1874, and to the hydrographic office for special duty in Narragansett's survey from 1875 to 1877. He was promoted to commander June 3, 1890, at the Naval Academy, and took command of the Concord in May, 1896. He became the chief of the hydrographic bureau April 19, 1897, which position he now fills with credit.

TREASURY OFFICIALS WHO DEAL WITH SHIPS.

BY THE REVIEW'S SPECIAL WASHINGTON CORRESPONDENT.

Lyman Judson Gage, secretary of the treasury, was born in De Ruyter, Madison county, New York, June 28, 1836. He received a common school education in his native county, and later, upon removal of his parents to Oneida county, he had for a short time the advantages of Rome academy. When his father, who was Eli A. Gage, moved to Chicago in 1855 the son entered, in a subordinate position, a banking institution in that city. He rose rapidly through the various grades until in 1868 he became cashier of the First National Bank of Chicago, and in 1882 its president as in fact he had been its manager for many years. The growth of this remarkable financial concern is a part of the life of Mr. Gage. Under his guidance it not only survived several trying periods in the history of the rapidly growing city, but it came to be a leading, and at times the most powerful bank in the United States.

Distinguished as have been Mr. Gage's achievements in building up a powerful banking house, they are, while better known, perhaps not to be compared with successes involved in the municipal growth of Chicago. The growth of that city from sixty thousand to nearly two millions of people gave full employment to his energies, both in relation to the many social and economic problems incidental to such a development and to the enormous expansion of business affairs of the bank to which he was related. There is scarcely any stage of development in the city's growth where his influence has not been felt. In civic matters, as well as in business affairs, he took a prominent and useful part. He was the first president of the Civic Federation of Chicago, a large organization composed of citizens representing all classes and creeds. This association has now had an honorable and useful history, having taken for years past an influential part in securing needed municipal reforms. With the incipiency of the World's Fair project in 1893 he was appointed by the mayor of Chicago chairman of the finance committee, and through his aids and subordinates succeeded in raising, by voluntary subscriptions toward that enterprise, between five and six millions of dollars. Upon the organization of the board of forty-five directors, he was unanimously chosen president, and by his energy, patience, skill and tact, carried the undertaking over the most trying period of its history.

He organized the Chicago Clearing House Association, was its president for a number of years, and always a member of the executive committee. He has three times been president of the American Bankers' Association, and president of the Commercial Club of Chicago, a strong organization limited in number to sixty and composed only of representative business men. He was one of the first to recognize that, in the cosmopolitan and heterogeneous population of Chicago, the elements of dissatisfaction and disorganization found good breeding ground. He therefore organized what became known as the Economic Conferences. His idea was to bring together all classes of citizens, rich and poor, the ignorant and the cultivated, that they might, in friendly discussion, learn each other's wrongs and together consider the remedy. He wrote the platform of the organization, one upon which citizens of all kinds could stand, and for three years during the winter he himself led discussions in conjunction with the representatives of socialism and other forms of revolutionary tendencies. The certain result was a better feeling among the classes, a bet-

EUGENE T. CHAMBERLAIN, Commissioner of Navigation.
SUMNER I. KIMBALL, Supt. Life Saving Service.
O. P. AUSTIN, Chief, Bureau of Statistics.
JAMES A. DUMONT, Supervising Inspector-Genl. Steam Vessels.
CAPT. C. F. SHOEMAKER, Chief, Revenue Cutter Service.
LYMAN J. GAGE, Secretary of the Treasury.

Official of the United States Treasury Dept. who deal with Shipping Matters.

ter understanding among the masses, and great good to the city's social and moral status.

He has contributed much by his pen to the public causes in which he has been interested. When in the early seventies the growth of the greenback movement became pronounced, he was active in organizing the Honest Money League, which began a campaign of education against the rapidly spreading movement for a permanent paper currency. His writings at that time were widely circulated, and doubtless contributed much toward arresting the spread of the movement. He is a clear writer, and his style possesses much literary merit. He has the happy faculty of stating the truth attractively and convincingly. His public addresses and state papers are likely long to be referred to as authority on the subjects of which they treat. He is a philosopher and a student of social and moral problems as they affect the nation's life, and he possesses still that force of intellect which has made him, for a quarter of a century, a leading citizen of one of America's greatest cities.

EUGENE TYLER CHAMBERLAIN, COMMISSIONER OF NAVIGATION.

Eugene Tyler Chamberlain was born Sept. 28, 1856, at Albany, N. Y., and was graduated at Harvard College with honors in metaphysics in the class of 1878. He taught in the Albany Academy, 1879. He was associated in the grain and grain elevator business with his father, General Frank Chamberlain, 1880-82. He then became associate editor of the Albany Evening Journal, and afterwards the Albany Argus for eight years, and was also political correspondent at Albany for various New York, Boston, Philadelphia and Washington newspapers, and Associated Press reporter for the New York senate for six years. He was editor of the Albany Argus for two years. His appointment as commissioner of navigation was from President Cleveland in 1893. He has since given his attention entirely to that office and has been identified with most of the shipping legislation of the last five years. Although the office is one that usually changes with a change of administration, Mr. Chamberlain has been retained on account of the very able manner in which he has conducted this branch of the treasury department service. A compilation of the "Navigation Laws of the United States," which he prepared in 1895, has met with great favor here and abroad. A second edition of this work, revised to date, was issued recently. Mr. Chamberlain has published five annual reports as commissioner of navigation. In 1884 he wrote a campaign life of Grover Cleveland, and during the last five years has been an occasional contributor to the magazines and technical (shipping) publications. He is a member of various scientific and social organizations.

CAPT. CHARLES F. SHOEMAKER, CHIEF OF DIVISION REVENUE CUTTER SERVICE.

Capt. Charles F. Shoemaker, chief of division revenue cutter service, was born in Glendale, Jefferson county, Iowa, March 27, 1841, and is a son of the late Captain William R. Shoemaker of the army. His early life was spent at the late frontier posts to which his father was assigned, where, with slight educational advantages, by his own perseverance and such assistance as he could obtain from his parents, he prepared himself so that by his seventeenth year he was able to enter the naval academy at Annapolis, to which he was appointed in 1858 from New Mexico.

During his third year he resigned and entered the revenue cutter service, in which he was commissioned third-lieutenant Nov. 20, 1860, and was attached to the cutter Lewis Cass at Mobile, Ala., when that state seceded from the union in 1861. The captain of the vessel turned it over to the state government and entered the confederate service, but Lieut. Shoemaker, together with the other officers and the crew, remained loyal to the government and made their way north. He served during the war on various vessels on guard duty at the port of New York and convoying vessels on the coast. In 1864 he resigned to engage in business, but in 1868 he was recommissioned a lieutenant and served until 1875 on the Atlantic coast, when he entered the office of the inspector of life saving stations as assistant. In 1876 he was appointed assistant inspector of the third district, comprising the coasts of Rhode Island and Long Island. He completely reorganized this district under the direction of the general superintendent of the life saving service, Sumner I. Kimball, to whose office in Washington he was transferred in 1878.

In 1882 he was detached at his own request and was assigned to duty as executive officer of the Seward, serving in the Gulf of Mexico, but in 1885 he again found himself at his old post in the life saving service as assistant inspector of the third district. Having once more put the district in a state of thorough efficiency, he was thereafter employed in the inspection of all the districts of the Atlantic and Gulf coasts. For three years, during the illness of the inspector, almost all of that officer's work devolved on Lieut. Shoemaker.

In 1894 he finally left the life saving service to take command of the Washington at New York. The following extracts from a letter written him at the time by Sumner I. Kimball, the general superintendent, bear witness to the value of his work in that division: "I cannot," wrote Mr. Kimball, "allow the occasion to pass without an expression of my personal and official regard for yourself and your services. The duties of assistant inspector are always important and oftentimes of very serious responsibility. In their discharge you have uniformly manifested great zeal and marked ability. I have never hesitated to entrust to you the most difficult cases requiring investigation and have found your examinations thorough, your conclusions sound and your recommendations impartial. The amount of important work you have accomplished proves your diligence and the results which have stood the test of time establish the value of your judgment."

In 1895 Lieut. Shoemaker was given command of the Hudson, continuing his station at New York. His commission as captain and the order directing him to report to the treasury department for duty as chief of division came to him by the same mail.

JAMES A. DUMONT, SUPERVISING INSPECTOR-GENERAL, UNITED STATES STEAMBOAT INSPECTION SERVICE.

James A. Dumont, supervising inspector-general, United States steamboat inspection service, is the sixth in the line of succession that have held that office since its creation under the act of congress approved Feb. 28, 1871. General Dumont began active life as cabin boy on a Hudson river sailing vessel at the age of thirteen, and continued in the business of navigation until his advent into the position he now holds, having served in every position incident to a nautical life (steam and sail), including that of master, pilot, owner and general manager and superintendent of one of the largest freighting lines on the Hudson river, besides having had six years of sea service on square rigged sail vessels, having, during such service, been twice around the world.

General Dumont was appointed supervising inspector general by General Grant in November, 1876, and is consequently drawing near the end of his twenty-third year of service, President McKinley being the seventh president, including the two terms of President Cleveland, under whom he has served, whilst Secretary Gage is the twelfth secretary of the treasury under whom he has served, including two terms of Secretary Wm. Windom (under Presidents Garfield and Harrison). Promptness in business methods is a feature of this service, it being a rule of the inspector-general's office that no communication received shall remain unanswered over night. General Dumont has always been in close touch with the officers of his service, with the steam vessel interests, the licensed officers and others, and he is largely responsible for many amendments to the laws made by congress favorably affecting such interests. Amongst such amendments may be mentioned the following as worthy of note: Repeal of the personal liability law, the tax for the inspection of steam vessels, and licenses of officers of steam vessels; law requiring the inspection of foreign steam vessels; law equalizing the salaries of local inspectors; law authorizing inspection of boiler plate at the mills; law authorizing towing vessels to carry persons other than their crews; law relieving lake and sound steamers from carrying "line carrying projectiles"; law requiring inspection of naptha and other motor vessels.

As showing the practical results of the work of this service during the twenty-three years (1877 to 1899) that General Dumont has been in charge, compared with the five years of his predecessors (1872 to 1876) a table was recently prepared in the office of the service, from which some extracts are made. This table reports annual average contingent expenses in the first five years as $47,313.81, against $42,809.76 during the twenty-three-year period; total number of steamers inspected in the first period, 19,019, against 150,925 in the second, and an annual average of steamers inspected of only 3,804, against 6,562. The total number of officers in the service in 1872 was 102, and in 1899, 182, or an increase of only eighty. The average cost, contingent expenses, inspection per vessel, 1872 to 1876 is given as $12.45, as against only $6.52 from 1877 to 1899, and the average cost of inspection per vessel in the year 1899 (fiscal year ends June 30) only $5.84, against $14.56 in the year 1873.

SUMNER I. KIMBALL, GENERAL SUPERINTENDENT, LIFE SAVING SERVICE.

Sumner I. Kimball, the general superintendent of the life saving service, is a remarkable man. He is a graduate of Bowdoin college and has been associated with the government in one capacity or another since 1868. He was appointed in that year chief clerk in the office of the second auditor of the treasury, where he remained until 1871. In the latter year he took charge of the revenue cutter service. During the seven years in which he was in control of this service he raised it to a point of great efficiency. Meanwhile he had been paying considerable attention to the need of an adequate life saving service and in an incidental way had been contributing to its value. There was practically, however, no such thing as direct governmental support and governmental supervision of the life saving service. The government gave some assistance but the work was largely performed by volunteer crews. A succession of disasters caused the government to turn its attention to the establishment of a capable life saving service, and Sumner I. Kimball was selected as the man to whip it into shape. The work which he did will ever be a monument to his credit. He found the equipment inadequate and the men incompetent. He found that appointments had been made in the service by political preferment and that consequently irresponsible persons had been appointed to office. He cleaned out the establishment and began the work anew. He possessed unusual powers of organization, and in a remarkably short space of time the life saving service of the United States became the admiration of the world.

Mr. Kimball was a delegate to the International Marine Conference in 1870 and has been a delegate to many conferences of distinction.

AUXILIARY STEERING GEAR.

Editor Marine Review: Noticing the remarks of Mr. Wm. T. Blunt and Mr. T. J. Elderkin on the character and use of auxiliary steering gear on lake steamers, permit me to say that all large steamers built by this company for some time past have been fitted with auxiliary steering gear and wheel, which is entirely independent of the steam gear, and which can be connected ready for use as quickly as the wheel can be manned. On one occasion the change from steam to hand was made in eleven seconds, and that, without previous notice that the change was to be made. We consider it important that no part of the hand gear should be in common with the steam, as any part breaking may disable both. Our gears are entirely independent.

FRANK E. KIRBY.

Detroit Ship Building Co.,
Detroit, Mich., Sept. 25, 1899.

It is now more than probable that Mr. George Y. Wisner of Detroit, member of the United States board of engineers on deep waterways, and who is so well posted on the subject of lake levels, will address the Cleveland Chamber of Commerce on that subject, with particular reference to a dam in the Niagara, at the next meeting of the chamber, Oct. 17. It is understood, of course, that whatever Mr. Wisner may say will necessarily be his personal views and not those of the United States board of engineers now investigating this subject. Any statement as to what the full board may finally say would, of course, be premature.

NEW DENVER CLASS OF UNITED STATES CRUISERS.

FROM SPECIFICATIONS AND PLANS FURNISHED BY THE NAVY DEPARTMENT.

The six new cruisers of the Denver class, United States navy, (Denver, Des Moines, Chattanooga, Galveston, Tacoma and Cleveland) are in one respect, that of being sheathed and coppered, a radical departure from previous practice; and they are in all other respects up to date. For many years Chief Constructor Hichborn stood almost alone in his advocacy of sheathing for ships' bottoms, but persistent argument, combined with many object lessons from the reports of our ships in service, which tended to prove the statements in favor of sheathing, have at last overcome the strong prejudice against it, and all of the twelve ships authorized by the last congress—three first-class battleships, three first-class armored cruisers and six protected cruisers—are to be sheathed and coppered.

On account of the congressional limitation of the price which the department may pay for armor, and the improbability of being able to get any armor at that price, the six ships of the Denver class are the only ones for which contracts can be made without further action by congress. Designs for these ships have been perfected by the bureau of construction and repair. They will be vessels of about the size of the Raleigh and Cincinnati, but improved and modernized. The latter ships were designed at the time when the craze for speed at all costs reached its maximum, and to attain this extreme speed, which it will be noted could only be maintained for a few weeks after they were docked and cleaned, on account of their rapidly fouling unsheathed bottoms, too many other qualities were sacrificed, and they are now being altered to remedy this defect. The Denver and her sister ships are designed for a speed of 16½ knots, but will only make 17 knots when pushed, while the Raleigh and Cincinnati were designed for a speed of 19 knots. The former will be able to maintain their designed speed practically indefinitely, while the latter could scarcely maintain a speed of 15 knots, and that with an excessive consumption of coal. The horse power required in the new designs is 4,500, as compared with 10,000 in the Raleigh and Cincinnati, which means less than half the weight of propelling machinery. General dimensions and features of the Denver and class will be as follows:

Length on load water line, 292 feet; length, extreme, 308 feet 2 inches; breadth, extreme, about 43 feet; mean draught at trial displacement, 2-3 coal, ammunition and stores, 15 feet 6 inches; extreme draught fully loaded, 16 feet 8 inches; trial displacement, about 3,100 tons; full load displacement, about 3,400 tons; coal carried on trial, 470 tons; total bunker capacity, not less than 700 tons; speed on trial, 16½ knots; type of engines, vertical inverted, four-cylinder, triple expansion; estimated indicated horse power, 4,500; type of boilers, water-tube; number of boilers, 6.

Main Battery—Ten 5-inch, 50-cal. B. L. R. F. guns.

Auxiliary Battery—Eight 6-pounder R. F guns; two 1-pounder R. F. guns; four Colt machine guns.

Sail area, about 6,000 square feet.

GUNS, COAL CAPACITY, FEATURES OF HULL CONSTRUCTION, ETC.

The guns will all be designed for smokeless powder, and the 5-inch guns will be more effective than the old type of 6-inch guns. Eight of them will be mounted on the main deck in recessed ports, the four forward ones having a range from right forward to 60 degrees abaft the beam, and the four after ones from right aft to 60 degrees before the beam. The two remaining 5-inch guns will be mounted behind shields on the spar deck—one forward and one aft. Four 6-pounders will be mounted on the main deck—two forward and two amidship, and four more on the spar deck. The two 1-pounder guns will be mounted aft on the main deck, and the Colt machine guns on the top of the hammock berthing amidship.

The coal capacity of these ships with bunkers full (700 tons) is sufficient to give them a radius of action at full speed of about 2,600 miles. At the most economical rate of steaming, probably in the neighborhood of 10 knots per hour, they will be able to steam about 9,800 miles without re-coaling, or more than sufficient to take them from San Francisco to Manila. The ammunition supply will be large, as it should be to make rapid fire guns effective. For each of the 5-inch guns, they will carry 250 rounds, and for each of the 6-pounders, 500 rounds.

The wood material used in the construction of the hulls will be reduced to a minimum. All the bulkheads on the gun and berth decks will be of metal, and they will each be fitted with a pilot house on the spar deck built entirely of non-magnetic metal. Where it is necessary to use wood for any purpose, it will be treated with the electric fireproofing process before being worked. A watertight deck covered with ½-inch plate will be worked from stem to stern, the sides sloping down to 3 feet below the water line, and the flat or midship portion rising 18 inches above the same. This will be on the line of the berth deck for the greater part of the length, but toward the ends it will slope down. On top of the watertight deck at the sides a belt of obturating material will be worked, covering the water line for the whole length of the ship. All of the propelling machinery, steering gear and magazines will be below the watertight deck. The rig will be two-masted schooner with signal yards on the foremast.

Each vessel will have two search lights, an electric signalling system and a complete installation of electric lights. The blowers for ventilation

INBOARD PLAN OF THE DENVER CLASS OF PROTECTED CRUISERS TO BE BUILT FOR THE UNITED STATES NAVY.

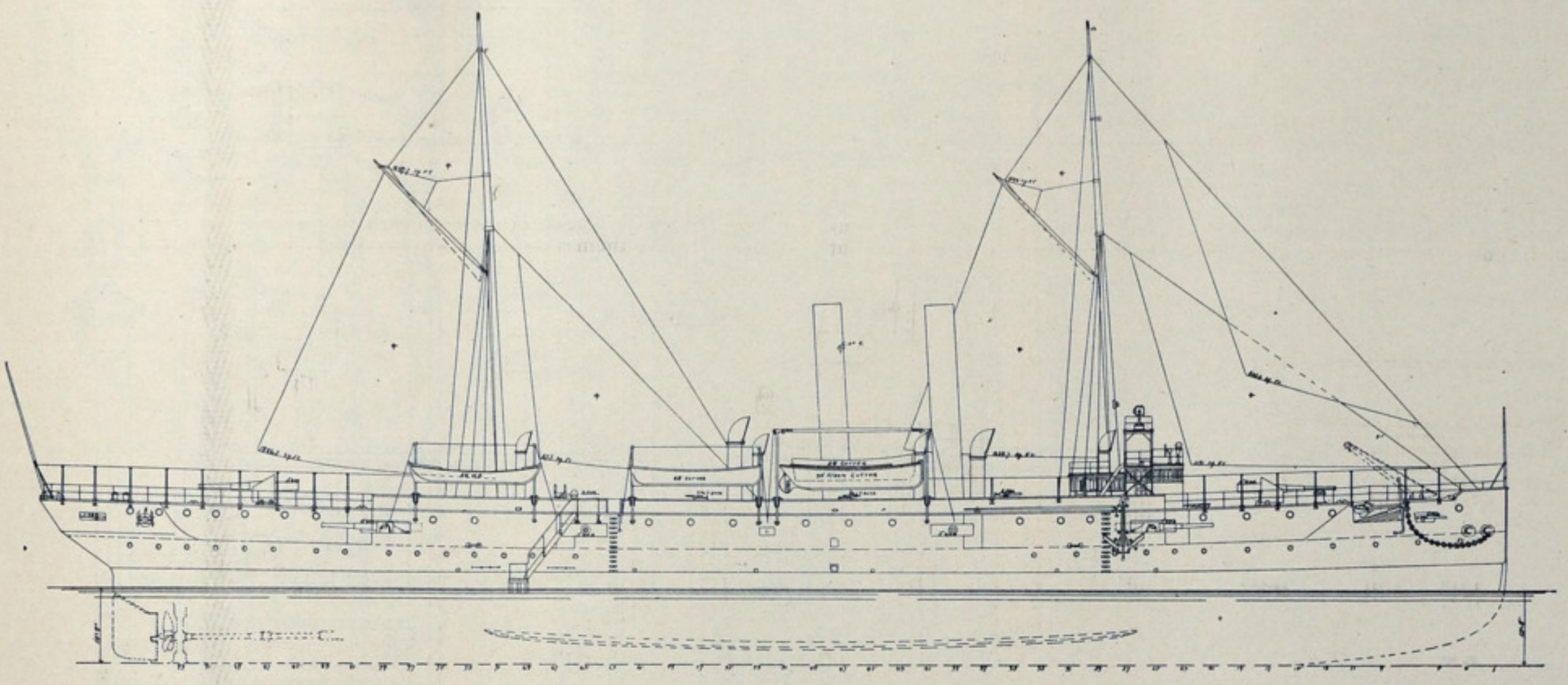
and deck winches will be operated by electricity. Each ship will carry one 30-foot steam cutter, one 30-foot launch, two 28-foot cutters, two 26-foot cutters, one 28-foot whaleboat gig, one 28-foot whaleboat, and one 18-foot dingey. The complement will be twenty-seven officers, 238 seamen and twenty-five marines.

ENGINES, BOILERS AND GENERAL MACHINERY EQUIPMENT.

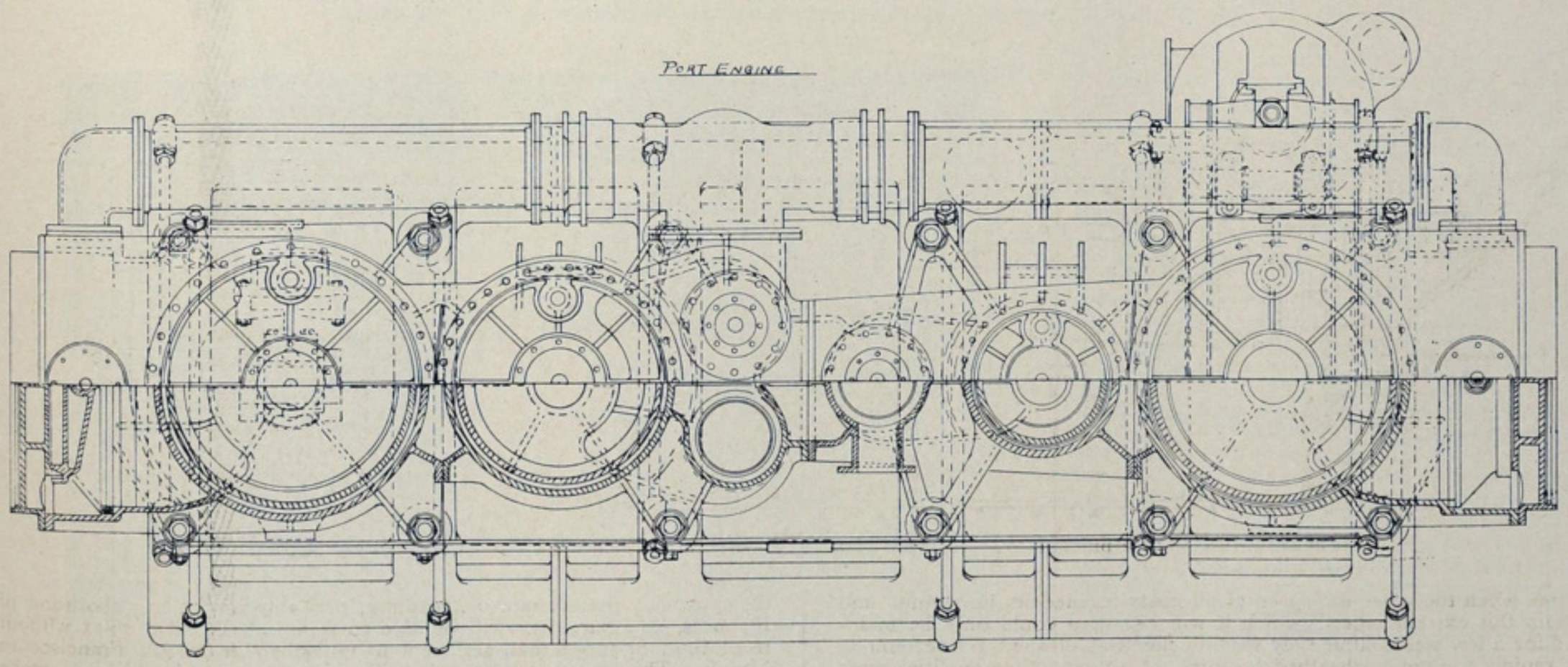
The propelling engines will be right and left, placed in watertight compartments, and separated by a middle-line bulkhead. These engines will be of the vertical, inverted-cylinder, direct-acting, triple expansion type, each with a high-pressure cylinder 18 inches, an intermediate-pressure cylinder 29 inches, and two low-pressure cylinders 35½ inches in diameter, the stroke of all pistons being 30 inches. The collective indicated horse power of propelling and circulating pump engines will be 4,500 when the main engines are making about 172 revolutions per minute, with a steam pressure of 275 pounds in the boilers, reduced to 250 pounds at high-pressure cylinders. The arrangement of cylinders, beginning forward, will be as follows: Forward low-pressure, high-pressure, intermediate-pressure, and after low-pressure. The forward low-pressure and high-pressure cranks will be opposite, also the intermediate and after low-pressure cranks, the second pair being at right angles with the first. The sequence of cranks will then be high-pressure, intermediate-pressure, forward low-pressure and after low-pressure. The main valves will be worked by Stephenson link motions with double-bar links. The valve gear of the four cylinders will be made interchangeable so far as is practicable. There will be one piston valve for each high-pressure cylinder and two for each intermediate-pressure cylinder. Each low-pressure cylinder will have a double-ported balanced slide valve.

The framing of the engines will consist of forged steel columns trussed by forged steel stays. The engine bed-plates will be of cast steel, supported on the keelson plates. All crank, line, and propeller shafting will be hollow. The shafts, piston rods, connecting rods, and working parts generally will be forged of open-hearth steel. The condensers will be made of composition and steel. Each main condenser will have a cooling surface of about 3,000 square feet, measured on the outside of the tubes, the water passing through the tubes. For each propelling engine there will be a single-acting, vertical air pump, worked from the forward low-pressure crosshead. The main circulating pumps will be of the centrifugal type, one for each main condenser. Each auxiliary condenser will have 400 square feet cooling surface, and it will have a combined air and circulating pump, and will be connected with all the auxiliary machinery.

There will be six boilers of the water tube type placed in two watertight compartments. The total grate surface will be at least 314 square feet, and the total heating surface about 12,600 square feet. Two blowers discharging into the forward and one discharging into the after boiler compartment, will be fitted, the compartments being air tight. As shown by the drawings two smoke pipes will be used. There will be one main feed pump and one bilge pump in each boiler compartment, and there will be located in each engine compartment the following steam pumps: Auxiliary feed, fire and bilge, water service, and hot well. There will also be a bilge pump for each engine, worked from a pin on the forward end of the crank shaft. Propellers will be right and left. Auxiliaries otherwise will include steam reversing gear, with oil control cylinder, ash hoists, turning engines, auxiliary pumps, engines for workshop machinery, distilling and evaporating apparatus, refrigerating machinery, and other essentials of modern equipment.



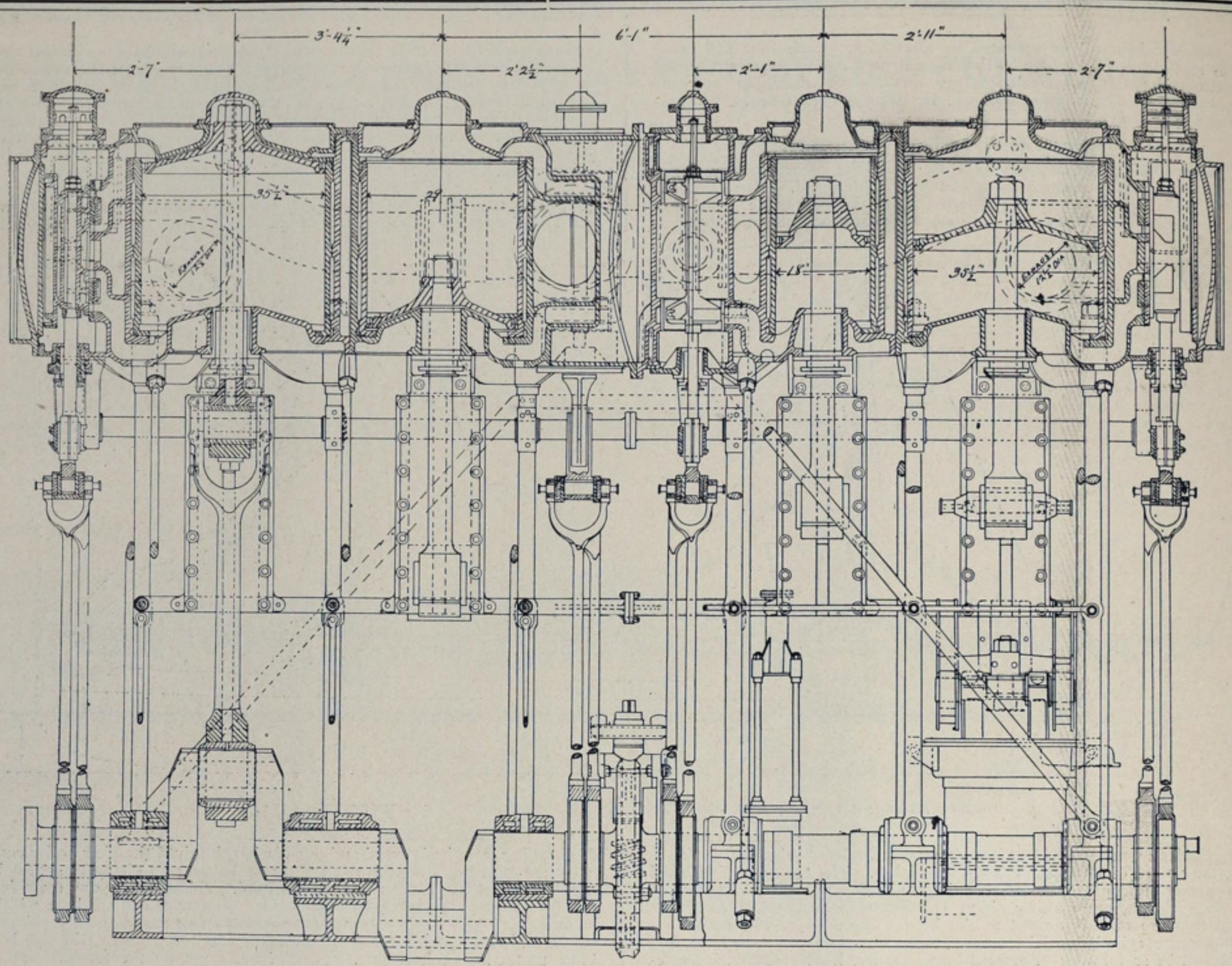
OUTBOARD PROFILE OF THE NEW DENVER CLASS OF CRUISERS OF THE UNITED STATES NAVY.



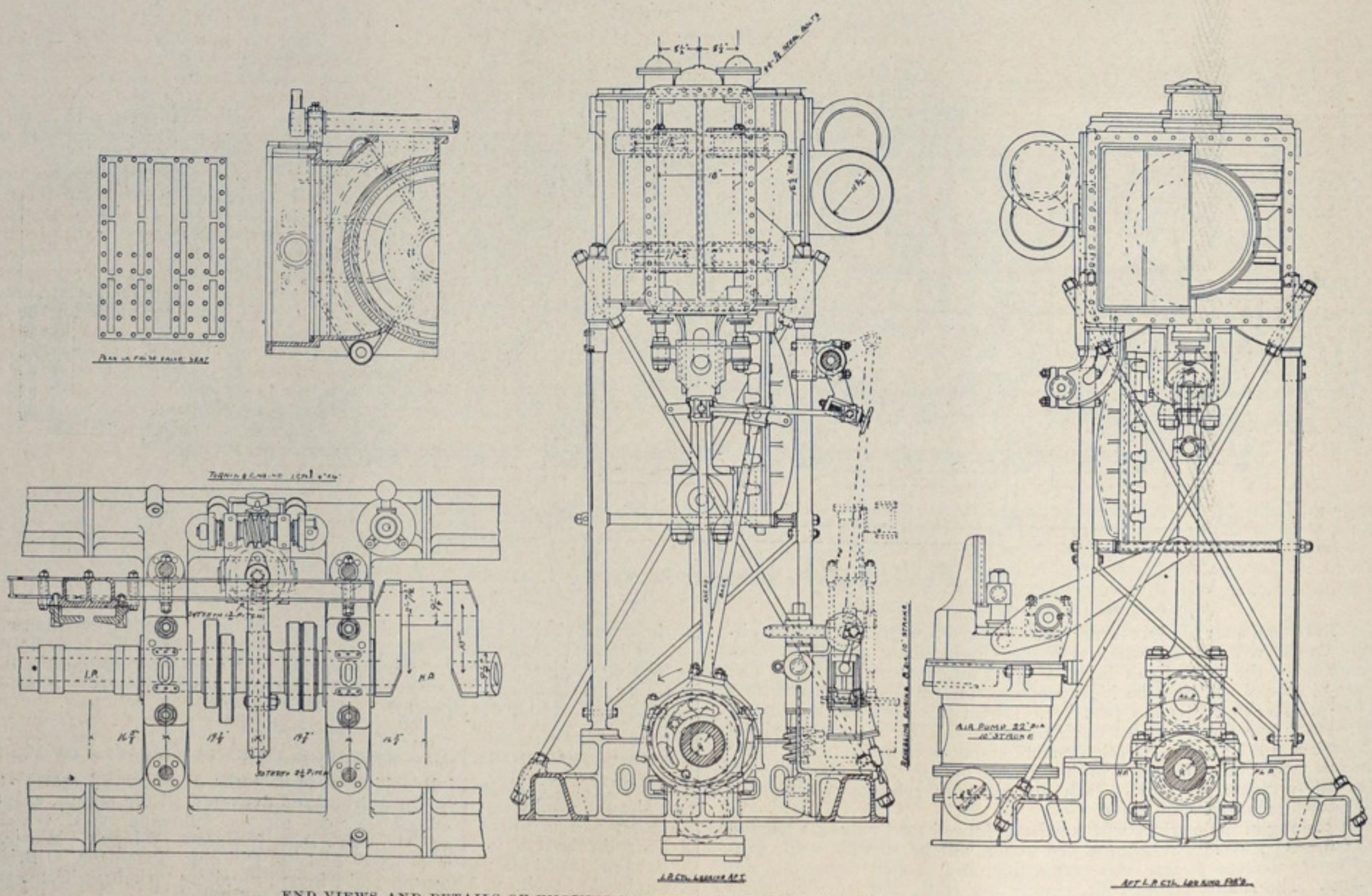
PLAN OF ENGINES OF NEW PROTECTED CRUISERS, U. S. NAVY, NOS. 14-19.

PUMPS, EVAPORATORS, ETC., FOR TWENTY VESSELS OF WAR.

M. T. Davidson of Brooklyn, manufacturer of improved steam and hydraulic machinery, has just finished and delivered all the pumps, evaporators and distillers, and ash ejectors for the following naval vessels: Torpedo boat destroyers Decatur, Dale, Truxton, Whipple, Worden, Barney and Biddle; torpedo boats Blakely, DeLong, Nicholson, O'Brien, Shubrick, Stockton, Thornton and Tingey; monitors Arkansas, Connecticut and Florida; and transports Sedgwick and Meade.



SECTIONAL ELEVATION OF ENGINES OF NEW PROTECTED CRUISERS, U. S. NAVY, NOS. 14-19.



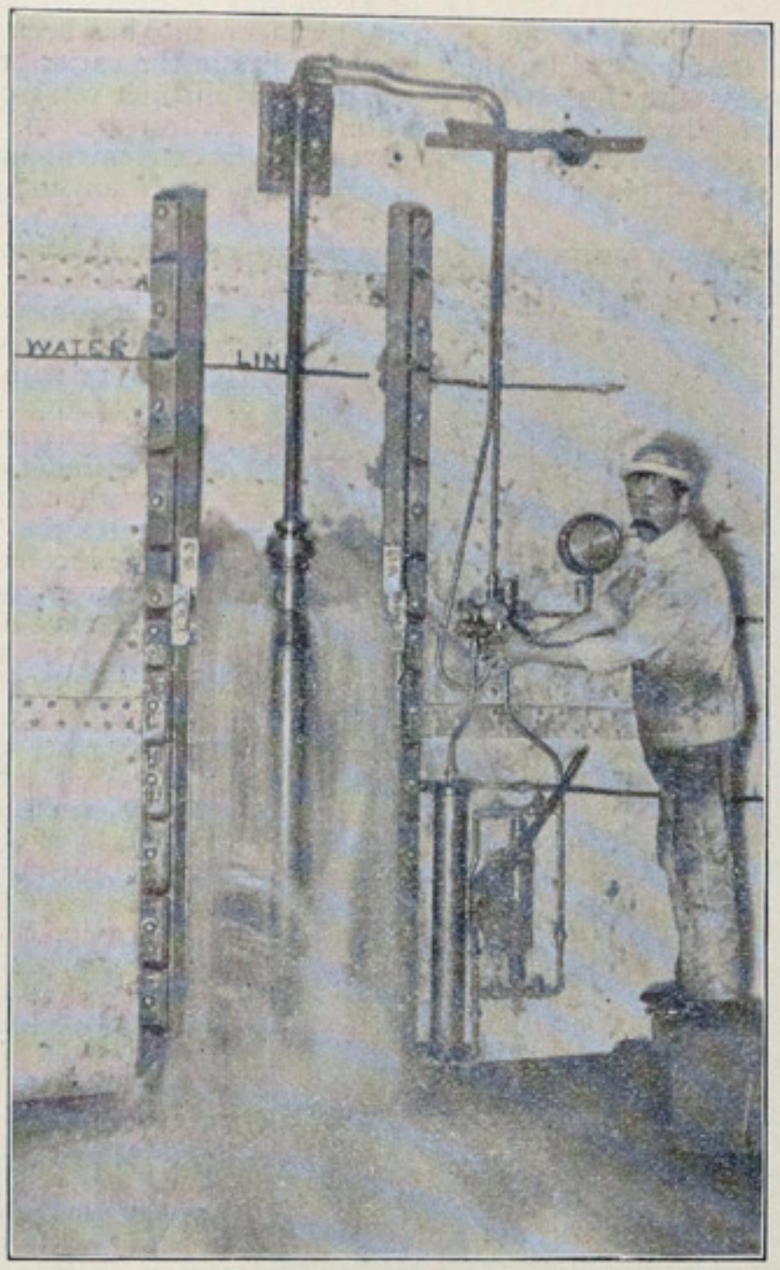
END VIEWS AND DETAILS OF ENGINES FOR NEW PROTECTED CRUISERS, U. S. NAVY, NOS. 14-19.

"LONG-ARM" CENTRAL-STATION POWER SYSTEM AND WATER-TIGHT DOORS FOR SHIP'S BULKHEADS.

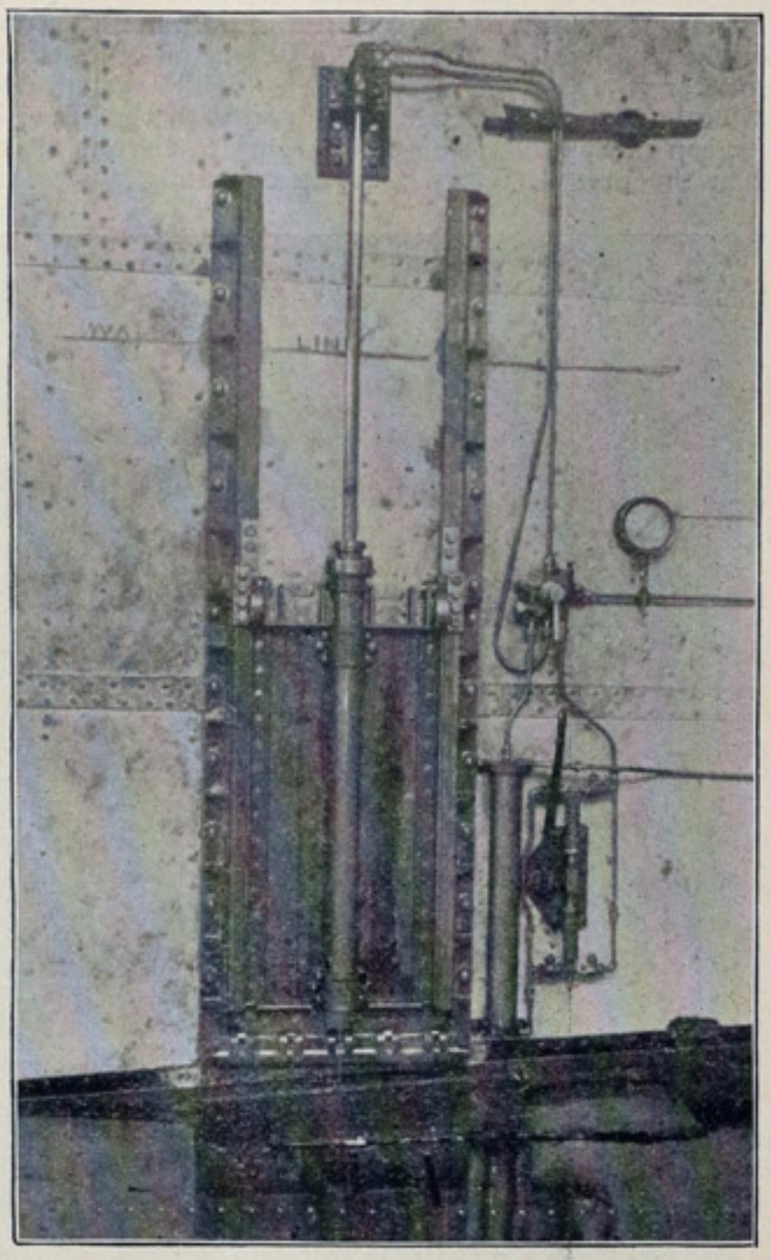
BY W. B. COWLES.

From the commencement of ship building in metal, especial attention and stress has been laid upon the importance of water-tight compartments to insure stability and flotation in case of skin-puncture. The use of a compartment system has been insisted upon from the very start. Underwriters, classification societies, shippers and the traveling public have become more and far more exacting in the matter of bulkheads as the use of ships and the risk of skin-puncture advance. The ostrich-like confidence of the traveling public in ships having an abundance of these much vaunted bulkheads has suffered a shock of late. Somehow these greatly advertised bulkheads have been found wanting just when most needed, and the cause has become plain. The common, so-called "water-tight door" has a way of resolving itself into nothing but a big hole when a collision comes, and a bulkhead with such a door in it is no bulkhead whatever within the accepted meaning of the term. And collisions do come. They come more and more often as traffic increases, and in the nature of things they are bound to develop into the most serious of all dangers to navigation, if they have not already attained that rank. Still, compartment systems are the only reliance after skin-puncture. They constitute the only known way to preserve ships, or, at the worst, to delay foundering long enough to save life.

As a rule, bulkheads in first-class ships are now numerous enough and perhaps strong enough, but they have often been proven as worthless as so much paper when called upon to perform their first and most vital duty. At this point some experts exclaim: "Abolish doors entirely; prohibit their use anywhere below the main deck!" And the writer would join in this cry if it were only a question of using this murderous type of door which always renders the compartment system unreliable and often makes it worthless. But this question cannot usually be settled by the ship builder or naval architect in any such "off-hand" and arbitrary manner. The men who handle ships and their motive power must be heard in the case. These men say, with hardly an exception, "we must have doors to run our ships efficiently."

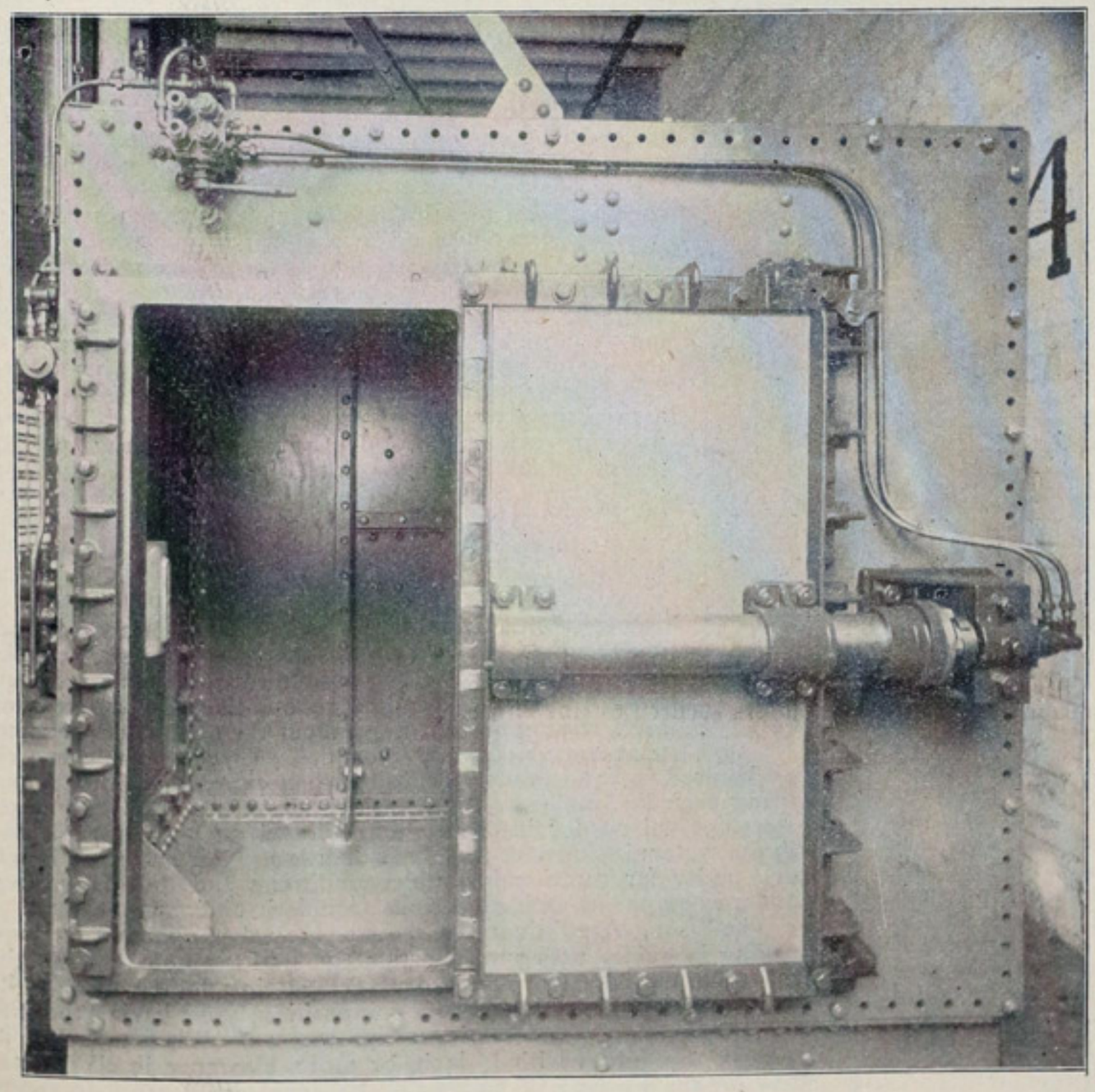


Clearway open 6 inches.



Shut and locked water-tight immediately after.—Coal swept away.

"LONG-ARM" WATER-TIGHT BUNKER DOORS ON THE UNITED STATES CRUISER CHICAGO—OPERATING IN COAL WITH WATER 7½ FEET ABOVE SILL.



"LONG-ARM" HORIZONTAL SLIDING DOOR, FULLY OPEN—CRUISER CHICAGO TYPE, 6-INCH TIGHTENERS.

There seems to be some radical change required if we are to actually use bulkheads for anything but structural strength. If we are actually going to have a water-tight compartment system, with necessary doors for efficiency, we find ourselves forced to adopt a safe type of door safely and quickly operated. In no other way can we eliminate the pretense in this matter and obtain real insurance value for the large amounts we now spend and waste on bulkheads. We cannot progress without some such radical change as was introduced on railways with the air-brake system, and to do this we need the acceptance and distinct recognition from all hands of certain axioms, which may be expressed about as follows: Water-tight doors and hatches must be given "equal rank and precedence with" the bulkhead or deck of which they form a vital part to preserve the cellular structure; things not vital in the general arrangement must give way to facilitate proper placing and control. Water-tight doors and hatches must never be dangerous to anyone under any conditions; otherwise they will be jammed or shored by someone, and so become a veiled danger instead of a vital element of safety. Water-tight doors and hatches must be able to close under a head and rush of water, and bunker doors must be able to close through coal. No hole must be cut in any bulkhead or deck except for some well-considered necessity seriously involving the efficiency of the ship for her peculiar duty; the cumulative convenience and health of the ship's people can be more safely recognized as a necessity when we have safe control of safe doors and hatches.

WHAT IS REQUIRED IN WATER-TIGHT DOORS.

History, present facts and the plain logic of the situation are now enforcing recognition of the foregoing axioms and the following corollaries: The hinged "barn-door" design should give way to the sliding "gate-valve" design; the former should not

be allowed as a part of the cellular structure. A door which fails to close and lock water-tight defeats the main object for which its bulkhead exists. The "officer of the deck," and the "engineer of the watch" should each have the power at hand to quickly close and lock all the doors and hatches embodied in the cellular structure. The preservation of the cellular structure is now "everybody's business" with the natural sequence. Place it within the direct and quick control of the two officers directly responsible for the ship and the result will be quite as satisfactory as that obtained with air-brakes in the cab of a locomotive.

Any system for the operation of doors and hatches from a distance, on shipboard, involves a careful consideration of its effect on the crew and the counter effect on the system itself. If the system does away with the valuable human discretion now lodged with the crew, it is plainly defective; if it can cause imprisonment or injury to anyone, it is dangerous and worse than the present doors with no operating system whatever. If, for instance, doors are arranged to be shut from the bridge or engine room platform (or if they are to be murderously released and dropped) men who have duties in the fire rooms, bunkers, magazines, etc., must face the additional chance of death from a guillotine or imprisonment and slow torture. And men will not run such risks when they can easily "doctor" the best possible door or hatch so as to jam it open; consequently no such scheme would be workable or reliable when placed in the hands of the crew. The successful system must win the co-operation of the crew instead of arousing combativeness. This can only be done in two ways—the system must relieve the crew from the manual labor of handling heavy doors and hatches and it must give each man on board full control of any door or hatch which he may come to for his individual safety; all this while insuring the integrity of the compartments when needed.

"LONG-ARM" VERTICAL SLIDING DOOR, FULLY OPEN—CRUISER CHICAGO TYPE, 6-INCH TIGHTENERS.

THE "LONG-ARM" SYSTEM—IT REACHES OUT.

The aim of this system is, first to construct all the doors and hatches in the cellular structure in such a manner that they may be operated on the spot by central-station power, closing and opening freely and with certainty; automatically locking water-tight on their seats by the act of closing and unlocking and freeing themselves automatically by the act of opening. Second, to place such central-station power under direct control from one or more emergency stations, so that all such doors and hatches may be closed quickly and simultaneously at any moment, in case of need, and so that during any such emergency operation and at all times any door or hatch may be operated independently on the spot. Fluid pressure, preferably pneumatic, has been adopted for use in this system. The working principle lies in the variation of pressure in a run of piping to obtain two separate and distinct ways of operating power cylinders connected therewith. The central station, for generating and storing power, may be placed in any convenient location and, for pneumatic power, consists of a small, high-speed air compressor, operated by steam or electric motor, with an air receiver consisting of the required number of storage flasks for the desired emergency capacity. The motor is automatically governed by the pressure in receiver.

A "two-pressure," automatic regulating valve is placed between the receiver and the pipe line. This valve is preferably of the type with pressure diaphragm working against the tension of springs. The springs are set to allow say 150 pounds pressure to pass from receiver to line. A small emergency-power cylinder is arranged to further compress the springs to a stop when the line pressure is admitted to said cylinder; this causes the "two-pressure" valve to admit say 300 pounds from the receiver to the line. The motor must be operated by some power always available on the ship and the receiver pressure may be 1,000 pounds.

Under the normal service working, the required capacity is very small, and the demand intermittent, with the working pressure constantly maintained in the line. Under emergency working, the pressure in the line is increased immediately, practically doubled, and the capacity required in the time set (say 40 seconds) for closing all doors and hatches, is about two-thirds of the total volume of all power cylinders, assuming that an emergency will always find at least one-third of the doors and hatches closed and locked.

The emergency station consists of a pressure gauge and a three-way cock, and may be placed anywhere. There may be two or more on a battleship or first-class liner, placed as desired. The emergency station is connected by ⅛-inch branch pipes, with the line at the nearest point and with the power cylinder on the "two-pressure" regulating valve at the receiver of the central station.

The line may be of ordinary hydraulic pipe and fittings to stand say 350 pounds air pressure. It may be run in any convenient manner, starting from the receiver at central station say with 1½-inch pipe and reducing to 1-inch, ¾-inch and ½-inch pipe for a uniform flow and delivery. The branches may be of ⅛-inch pipe leading to the poppet valves with a cock to isolate any door or hatch for inspection and repair. On account of the small size of these pipes, and the fact that they contain air only, they may be run almost anywhere to avoid other important things and may be bent in short turns and passed water-tight through bulkheads and decks at small expense. They require no protection.

A poppet valve box is provided for each door and hatch in the system. It contains the operating-liberty valves, and is placed conveniently with handles on each side of the bulkhead or deck. The indicating screw on the grip of each handle must be carefully placed after installation to indicate the opening direction; this avoids any possible confusion. Under the normal service working the poppet valve handles are used and any power cylinder, with its door or hatch, can be moved, controlled and locked in any position at will by the operating-liberty valves and the working pressure; the handles and valves instantly returning to their normal, closed position when the handle is freed. Under emergency working, to close all the doors and hatches simultaneously without the use of poppet valve handles, the following takes place: The emergency gear being operated, the pressure doubles up, approximately; this causes it to pass through the first relief valve in each poppet valve box to the closing pipe of each power cylinder; the power pistons, with this double pressure on the large ends, push the air out of the small ends, through the second relief valve in each poppet valve box, to the atmosphere; thus closing and locking all doors and hatches in the system.

MAINTENANCE, DESCRIPTION OF DOORS, ETC.

The work is a simple push and pull at moderate speed under complete control, and the use is occasional only. The details are as simple as possible to obtain this result and the working parts can not foul up, and therefore the wear and care are a minimum. Nothing about the system can be affected by temperature, dust or moisture. Glycerine or calcic chloride may be used in hand pump reservoirs when exposed to low temperature. During periodic "bulkhead drills," which are now a regular thing on first-class ships, all needed inspection and adjustment may be made to maintain the system in constant working condition. Air brakes on freight cars work under far more unfavorable conditions and they have become a standard equipment with no serious trouble in their maintenance.

The "Long-Arm" door is a sliding gate-valve, operated by power and working in guides with special arrangements for automatically tightening itself when closed. The standard vertical sliding door is made as light as feasible, of steel plate riveted to a composition frame having the stiffeners, plow-share, wedges and seating strips cast on. When unlocked it rides freely in the guides with ⅛-inch, or more, clearance in all directions to allow for the warping of bulkhead. Its edges are flexible, to conform to the action of the tighteners and make a better fit on a warped seat. The frame and guides are as heavy as feasible, of cast steel or malleable iron.

The tighteners are spaced not over 9 inches between centers throughout the periphery of the door. (In the ordinary door this spacing is from 18 to 24 inches.) Wedge surfaces throughout are made with an incline of 1 to 8; this prevents all "biting," a very important item in the efficient working. Every wedge works on a roller. The side tighteners consist of bronze rollers held in wrought iron bars and against the door wedges; a bar the full length of door each side; all within the guides to avoid fouling. The roller-bars ride on the door throughout its travel, except during the short tightening interval of say 1 inch at the closing end of the stroke, within which the roller-bars are held stationary on the guides, thus causing relative movement to engage the rollers and wedges, and press the door against the seat. The roller-bars are controlled by steel interlocking toes pivoted on the door, each with a slot engaging a pin in the top end of its bar.

During all movement outside of the tightening interval the points of interlocking toes ride under the upper guides, locking the bars on the door. During closing, within the tightening interval, these toes engage adjustable rollers on the guides throwing the toes out and locking the bars on the guides. During opening, within the tightening interval, the toes are held by adjustable stops on the guides, still locking the bars on the guides until the tighteners are entirely slacked up. The bottom tighteners are steel rocking-toes secured on a wrought-iron shaft running through steel eye-bolts which hold the bottom of frame on the bulkhead. When the door is free these toes and their connecting webs press against the seat, by the action of enclosed, torsional springs, thus forming a seat-guard.

During locking, the beveled edge of door and plow-share with its slightly raised wedges first close the clear-way and then engage the bronze rollers in points of rocking-toes, opening them out until the heels of toes bear on the frame; further movement wedges the bottom of door against the seat. During unlocking, these rocker-toes follow in and close on the seat before the clear-way is opened. Thus nothing can foul the bottom tighteners, and the small amount of dust which is ground down in falls through to the floor. The top tighteners consist of plain wedges on the top stiffener of door engaging bronze rollers on the door-bridge. They are not in a position to foul up and can be easily inspected.

The standard horizontal sliding door has some slight modifications in the tightening gear, the above described "side tighteners" becoming top and bottom tighteners for this door. Riding rollers are fitted to take the weight of door. In other respects this door is similar to the vertical type.

The "Long-Arm" hand gear consists of a small hand pump with leather-faced check valves quickly accessible, a hand brake on each side of bulkhead or deck, and a water reservoir of sufficient capacity to fill the power cylinder. A check valve is placed in the line branch at poppet valve to hold the hand pump pressure. The relief connection from poppet valve to atmosphere is run through a separator-muffle head on the top of reservoir, and the hand pump is piped into the circuit with ⅛-inch pipe from the bottom of reservoir. Pressure in the line branch being lost from any cause, the hand pump brake is shipped and water is pumped into either end of the power cylinder by operating the poppet valve handles, as usual, to open or close the door or hatch. This may be repeated indefinitely, as no water is lost, the air only escaping. When pressure in line branch again becomes available the regular power operation blows the water out of power cylinder, leaving it in the reservoir for further and instant use.

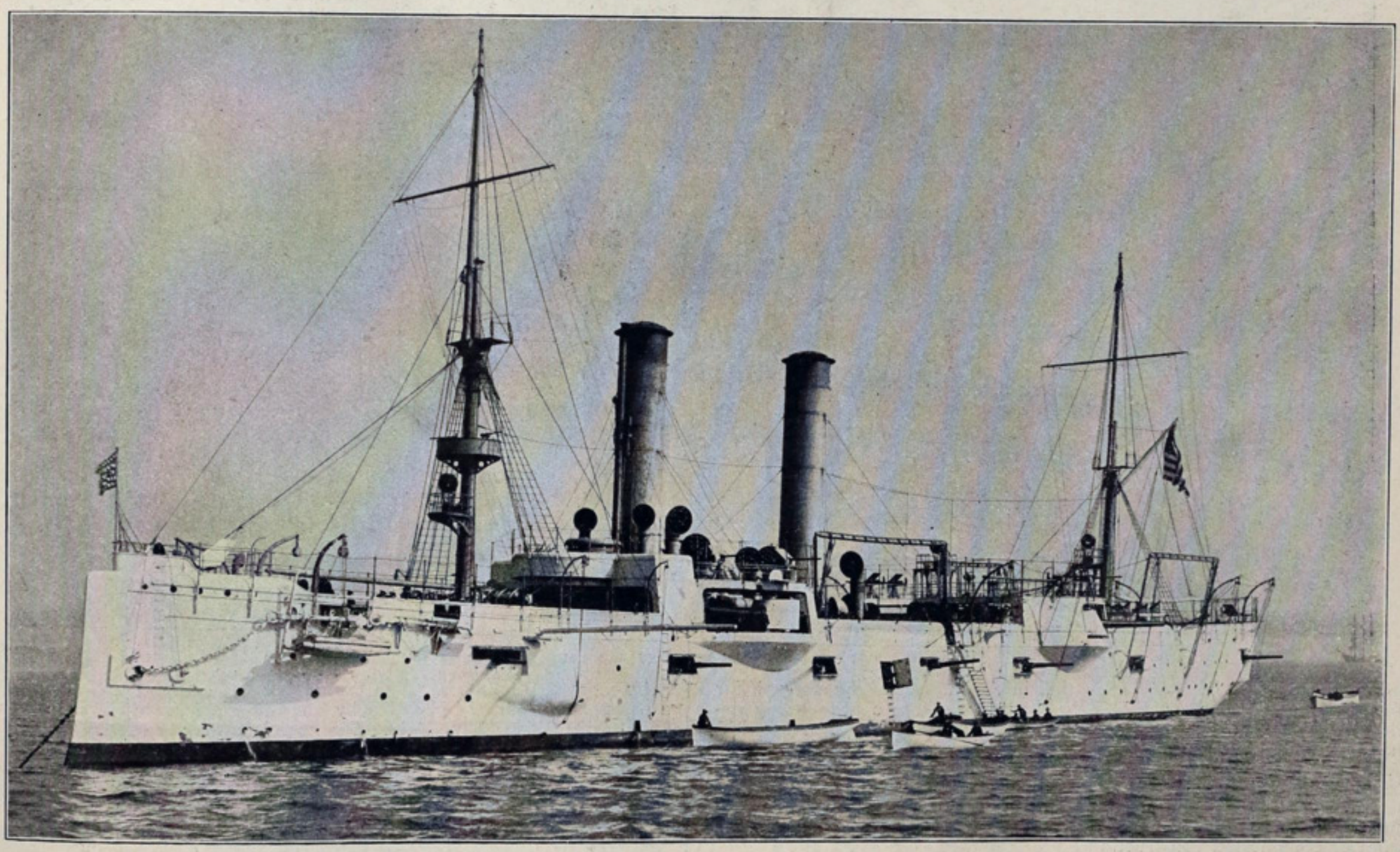
RESULTS FROM TESTS.

The severe, thorough and extensive tests of the United States cruiser Chicago's installation of eleven doors, carried on by the United States government continuously while outfitting and afterward in regular service, from January 1898, to September 1899, are unique. So far as the writer knows no other authoritative experiments and tests on any such scale have been made in connection with this subject. The writer is not at liberty to quote government reports, but it is allowable and proper to say here that the outcome has been entirely satisfactory, and as a result arrangements are now progressing for the extensive introduction of this system and type of door.

These tests show under normal service working and a 4-foot travel: With power—Time to unlock and fully open, not over 30 seconds. With power—Time to fully close and lock, not over 15 seconds. By hand-pump—Time to unlock and fully open, not over 50 seconds. By hand-pump—Time to fully close and lock, not over 25 seconds; one man with ordinary effort on hand-pump.

The tests under emergency working show: Time to fully close and lock all doors in the system, from instant of turning emergency cock, not over 40 seconds; time to unlock and fully open any 4-foot door in the system by "liberty action," not over 10 seconds.

The "Long-Arm" System Co. of Cleveland, is now prepared to furnish the above described central stations, doors, hatches, power and hand gear, in any quantity; and to furnish plans, expert advice and superintendence in fitting installations of the same on board ships. The "Long-Arm" System doors and hatches are protected by a series of broad patents in the United States, Great Britain, France, Germany, Russia, Italy, Japan, Austria, Denmark, Belgium, Norway, Sweden and Canada.



Copyrighted 1899 by E. Mueller, Brooklyn. UNITED STATES PROTECTED CRUISER CHICAGO, FITTED WITH THE "LONG-ARM" SYSTEM AND DOORS.

It is said that the Jenks Ship Building Co. of Port Huron is asking $170,000 for the Welland-canal-size steel steamer which they have under construction. The vessel will be a good one, especially from a structural standpoint. Her dimensions are 243 feet keel, 43 feet beam and 26½ feet moulded depth. She will be double-decked, and in a general way similar to the Eureka and other vessels of her class. Engines will be triple expansion with cylinders of 17½, 28 and 47 inches diameter and 40 inches stroke. Dimensions of boilers—two of them—are 11 by 12 feet with 181 pounds steam pressure.

After selling his steamer Sauber, a few days ago, to Messrs. Becker and Mullen of Cleveland for $100,000, Capt. John Mitchell said he was still determined to sell other small vessels of his fleet so as to have only the big steel steamers that he has acquired within the past few years.

Since spring the Chase Machine Co. of Cleveland has added several thousand dollars worth of new machinery, and now has one of the best equipped of the moderate size machinery plants on the great lakes.

Extra copies of this edition of the Marine Review will be mailed to any part of the world at 25 cents. Subscriptions sent direct now will include this issue and will run to Jan. 1, 1901.

GOOD EXAMPLE SET BY THE GOVERNMENT.

UNIFORMITY IN THE USE OF A BOAT DETACHING SERVICE—THE KIND OF HOOK ADOPTED FOR UNITED STATES VESSELS.

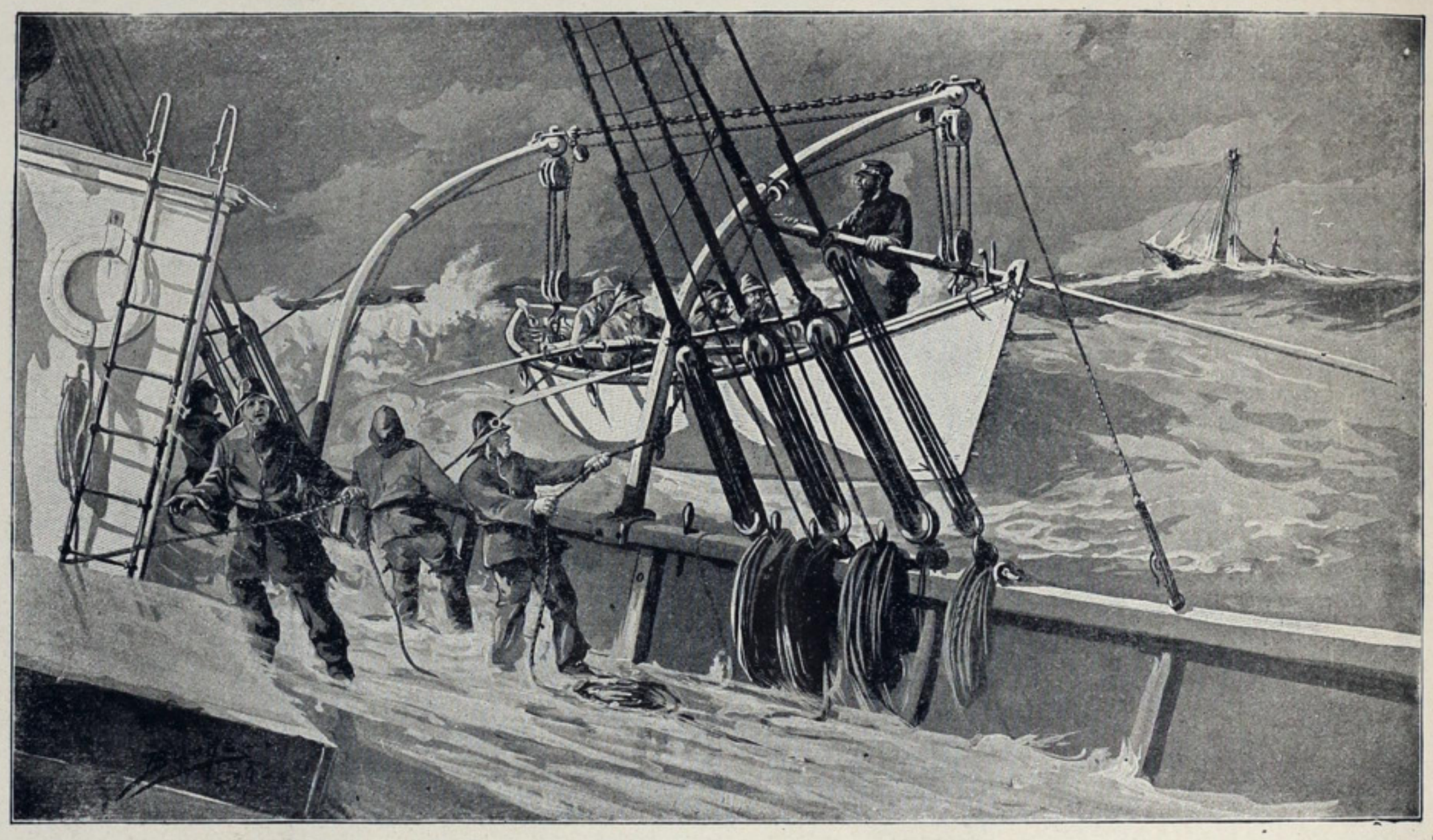
In the season of late fall and winter—the time of storms on the ocean and the great lakes—the columns of the daily press are frequently filled with accounts of disaster at sea, of noble craft foundered, of bravery on the part of unfortunate shipwrecked seamen, and of acts of heroism performed by the crews of passing vessels in rescuing, or attempting to rescue, those in danger.

It is indeed very seldom that a sailor hesitates when called upon to take his place in the boat, notwithstanding the dangers threatening and the uncertainty of clearing the boat from the ship's side. Hundreds of lives have been lost through the inability of the boat's crew to get away from their ship, owing to the faulty construction of the apparatus for lowering the boat. It would seem that in the interest of humanity, if for no other reason, no effort should be spared to secure boat-lowering devices that will act with absolute certainty at any moment. But notwithstanding all that has been said on this subject, it would seem that in fitting out vessels there is still a woeful lack of the attention that should be given to the appliances for lowering and detaching boats, and the sailor is often called upon to perform work at the most perilous time with antiquated appliances that are inoperative—or nearly so—owing to rust, paint or complicated construction.

Boat drills calculated to familiarize the men with the use of these devices are too often inadequate, the boats being merely swung outboard and inboard and seldom lowered into the water and detached—the most important part of the drill. Further than this, such drills are often superficial, even if an effort is made to use care with them, owing to the great number of boat-detaching appliances, all materially different in construction and operation. A sailor hardly becomes familiar with the working of one device when he changes his berth to some ship fitted in an entirely different manner.

It has been wisely suggested that some one good device, one that has endured the severest tests, be universally adopted. In such an event all sailors would know just what to do in time of emergency. The United States government has lately set a good example by equipping all of the army transports with one device and has ordered all naval stations to keep a supply on hand for the purpose of substituting them for others on government vessels when they are being repaired; and so it is expected that in the near future all government vessels will be fitted with this one device, and many of the dangers attending the handling of life boats will be eliminated.

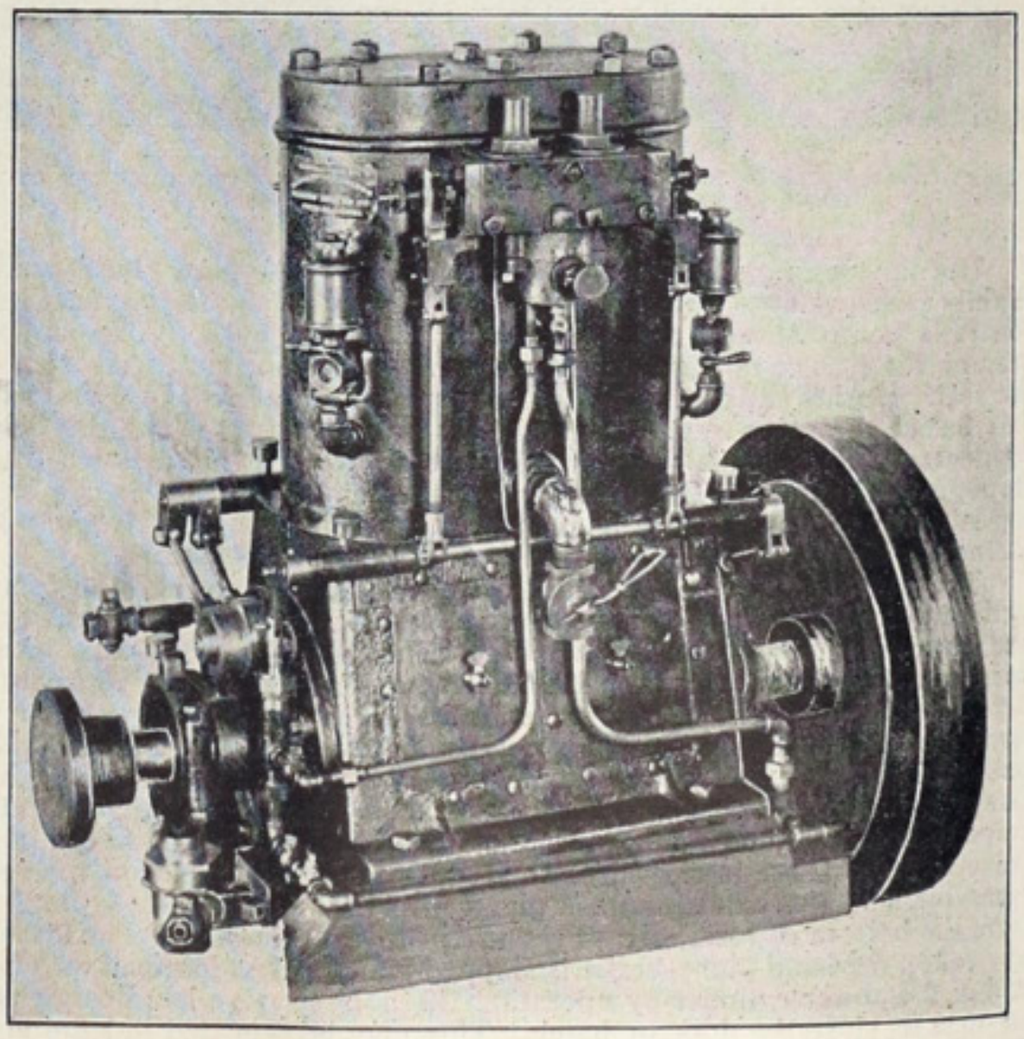
The Standard Automatic Releasing Device has stood the test of years and has always proved most reliable and expeditious in the launching of boats, and for this reason has been adopted as mentioned in the foregoing paragraph. The accompanying illustration shows a boat equipped with this device being lowered to go to a vessel in distress. The lowering is managed entirely from the ship's deck—if desired—and as no one is required to stand by to unhook the blocks from the rings in the boat, the men at the oars are enabled to pull away from the side immediately, thus lessening very materially the chance of smashing the boat against the ship's side. As will be observed from the construction of the boat and the mode of reeving the falls, both ends of the boat detach simultaneously, irrespective of which end strikes the water first. It will also be noted, as has many times been proven by tests of this device, that the boat can be lowered by one person, if required. In event of the sea being too rough to risk the life of a boat's crew, the boat may be lowered empty and detached and allowed to drift down on a wreck guided by a painter of sufficient length. It is obvious that this would be impossible were it not for the fact that the operation of unhooking is absolutely automatic. The construction of the hooks is such as to make hooking on in a rough sea or in darkness, a certainty, without injury to the hands of the men hooking the boat on. This is accomplished by the aid of a lanyard rove in the bills of the hooks, an important feature not heretofore taken into consideration in the launching and hoisting out of ships' boats. Both acts—detaching or hooking on—may be accomplished with equal certainty whether the ship is in motion or at anchor.



STANDARD AUTOMATIC BOAT DETACHING DEVICE IN OPERATION,

GARDEN CITY MARINE GASOLINE MOTOR.

The accompanying cut shows a Garden City marine four-cycle gasoline motor which the makers claim to be superior to and more reliable than any built on the two-cycle system. They are built with one, two, three or four cylinders. The design is neat, compact and simple. The cylinders are entirely enclosed by one water jacket, which connects with the water jacket in the head. The base is entirely enclosed and contains



oil in which the cranks slush, thus making all interior mechanism and crank bearings self-lubricating. The piston is so constructed as to always carry oil that is slushed into it by the crank from the base, and thus it

lubricates the cylinder at every point of the stroke. The circulating water is discharged from the head through a special port and out through the exhaust pipe, keeping the pipe always cool. The exhaust is carried directly under water, without the use of a muffler, thus preventing noise and odors. The compactness of this engine peculiarly adapts it for auxiliary work in sailing vessels. The engine works under low compression, thus reducing vibration and permitting the use of a lighter fly-wheel and the running of engine at a lower speed. The speed of the engine is controlled by throttling the air valve, which, for convenience sake, may be located in the bow of the boat near the steering wheel. The gasoline tank is placed in the bow of the boat. A pump is provided to keep a constant supply of oil in a small siphon cup located directly under the induction valve and provided with an overflow pipe, which prevents flooding. The overflow returns into the main pipe back of the check valve. Air and gasoline meet in the siphon chamber; the mixture is instantly vaporized and the vapor then passes into the cylinder in an even charge. The igniter is the new Cotton & Kunze igniter, which insures clean contact points and accurate timing of ignition by the use of a divided electric current from either battery or magnets on the engine.

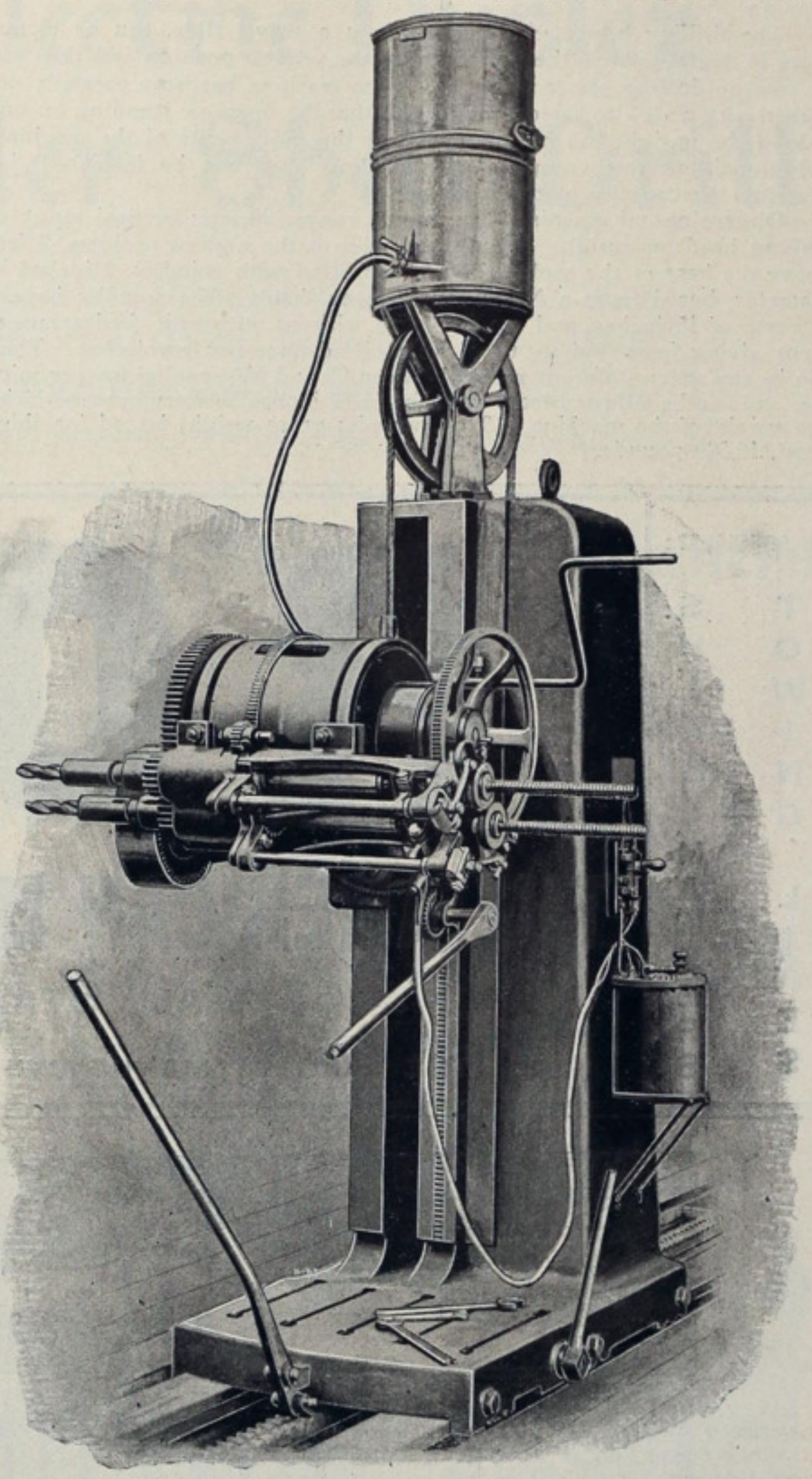
This motor is manufactured by the Garden City Motor Co., 105 W. Monroe street, Chicago.

DUPLEX BOILER SHELL DRILL.

In this type of machine, manufactured by Thos. Dallett & Co., Philadelphia, as in the former rope-driven type built by this firm, the boiler shell is placed horizontally upon four or six rollers in front of the tool; then by placing the spindles horizontally at the height of the center line, or pointing up towards the center line, and turning the shell, all the holes in the circular seams can be reached, and by moving the upright along the bed all the holes in the longitudinal seams can be drilled.

The machine, as seen in the illustration, consists of a cast-iron bed, made of any length desired, on which is mounted an upright, the weight of which is carried on roller-bearings, thus enabling it, by means of a lever and ratchet arrangement, to be easily moved along the bed. The upright carries a swivel slide, to which is fastened the drilling head, the whole being counter-weighted so that it can be easily moved vertically upon the upright by means of a rack and pinion operated by a ratchet wrench. The drilling head consists of the electric motor, around the circumference of which are moved and fastened the spindle frames. The motor being of the enclosed multipolar type, is well adapted to the boiler shop use, as it is practically dust and water proof. It is furnished with roller bearings and end ball-thrust bearings so that it can be run in the vertical position, and is furnished also with a starting and controlling switch, by which, in connection with the back gearing, the spindles can be run at ten different speeds for different sized drills, and the change of speed in the motor is accomplished without decreasing its power. The spindle frames are held firmly to the motor by V gibbs at the ends and bolts locked in T slots around it. They are easily moved in setting, by means of a ring gear around the motor and pinions on the spindle frames, by which they can be moved either singly or both together.

The spindles can be grouped in either the horizontal or the vertical plane or in any position between them, by which arrangement both spindles are always operative at all the holes in the shell. Each spindle has an independent automatic feed arrangement and there is a quick hand-feed by which either spindle can be advanced separately or both together. This hand-feed with a sliding sleeve socket can be used in tapping and screwing in stay bolts. The starting and controlling switch and rheostat is substantially made and coated with a waterproof material, so that it will withstand moisture. It is furnished with a magnetic circuit-breaker, to guard against overloads, which is also used as a main switch, so that the current is always broken on a knife switch, thus preventing any burning



of the contacts of the controller. By the arrangement of the controller a difference in ratio of speed of from one to two is obtained, and this variation is accomplished in such a manner that the full power of the motor is

retained at all speeds. The controller is also furnished with a reversing switch, by which the spindles of the drill can be reversed in such work as tapping.

The drilling head, being mounted on a swivel slide, can be turned from 45 degrees above the horizontal to the vertical position and thus can be used in drilling plates in the flat. The machine has been carefully designed with a view to rapid handling, so that the operator standing on one side of the upright has full control over the movements of the machine. Additional uprights complete with drilling head can be furnished, increasing the capacity of the machine.

Dimensions of machine—Horizontal range, 20 feet; vertical range of drilling head on upright, 4½ feet; spindles in the highest position, 7 feet above the base of the tool; drilling head fitted with spindles, 2 inches in diameter, bored to fit a No. 4 Morse taper shank. The spindles have a traverse of 15 inches, and are furnished with an automatic feed arrangement giving from .004 to .01 of an inch advance per revolution. They can be run at ten different speeds between 35 and 150 revolutions per minute, and can be adjusted from 4 inches to 17 inches between centers. The net weight of the machine is 9,000 pounds; gross weight boxed for shipment, 10,500 pounds.

CLASSED IN GREAT LAKES REGISTER.

The following vessels were classed in "Great Lakes Register" during the month of August, 1899: Steam—Alice Stafford, Arizona, Arrow, Chili, City of Rome, Glengarry (Can.), Gordon Campbell, Nellie Torrent, Norma, Progress, Spokane, Volunteer, Walter Vail; also the tug Peter Smith for ocean service.

Sail—Aberdeen, Baltic, Ellen Williams, Exile, John Kelderhouse, Plymouth, Scotia, Tyrone, William Crosthwaite, Winnipeg (Can.).

Probably the biggest freight ever earned in the ore trade of the great lakes was paid a few days ago by M. A. Hanna & Co. of Cleveland to Mitchell & Co. of Cleveland on a cargo of 6152 gross tons of ore brought down by the new steamer Frick. The freight was $2 a ton, or $12,304 gross. This was earned in a trip of eleven days, including three days in unloading. In their twenty-five years of business M. A. Hanna & Co. have never before paid a freight as big as this.

It is understood that Drake & Maytham of Buffalo have about concluded negotiations for the purchase of the steamers Ira Owen and Parks Foster at a figure somewhere in the neighborhood of $240,000. The Buffalo company will have quite a fleet of steel vessels if they secure these two steamers.